

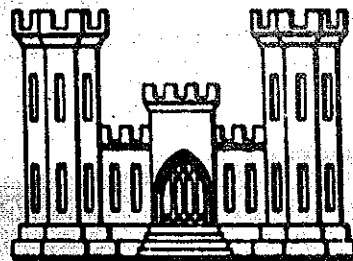
CONNECTICUT RIVER FLOOD CONTROL

**MAD RIVER
DAM & RESERVOIR**

MAD RIVER, CONNECTICUT

**DESIGN MEMORANDUM NO. 4
GENERAL DESIGN MEMORANDUM**

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**U.S. Army Engineer Division, New England
Corps of Engineers Waltham, Mass.**

MARCH 1960

407-6721

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND

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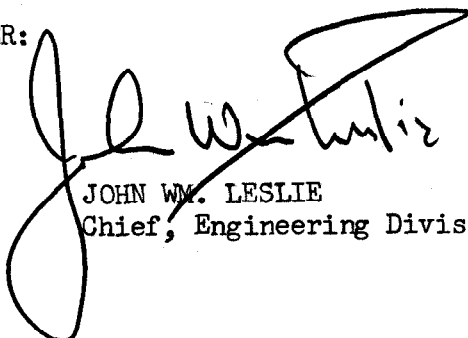
4 March 1960

SUBJECT: / Mad River Dam and Reservoir, Mad River, Connecticut
River Basin, Connecticut, Design Memorandum No. 4 -
General Design /

TO: Chief of Engineers
Department of the Army
Washington, D. C.
ATTENTION: ENGCW-E

There are submitted herewith for review and approval
12 copies of Design Memorandum No. 4 - General Design for the
Mad River Dam and Reservoir, Mad River, Connecticut River Basin,
in accordance with EM 1110-2-1150.

FOR THE DIVISION ENGINEER:



JOHN WM. LESLIE
Chief, Engineering Division

Incl
Des Memo No. 4 -
General Design
(12 cys)

FLOOD CONTROL PROJECT
MAD RIVER DAM AND RESERVOIR

MAD RIVER
CONNECTICUT RIVER BASIN
CONNECTICUT

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2	Site Geology		
3	Concrete Materials		
4	General Design Memorandum	4 Mar 1960	
5	Embankments and Foundations		
6	Detailed Design of Structures		

*Initial submission in draft to secure approval of spillway design flood, and top of dam elevation.

MAD RIVER DAM AND RESERVOIR

MAD RIVER

CONNECTICUT RIVER BASIN

CONNECTICUT

DESIGN MEMORANDUM NO. 4

GENERAL DESIGN MEMORANDUM

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2	Letter, Federal Power Commission - 29 January 1960

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MAD RIVER DAM AND RESERVOIR
MAD RIVER
CONNECTICUT RIVER BASIN
CONNECTICUT

A. PERTINENT DATA

1. Purpose. Flood Control

2. Location of Dam.

State	Connecticut
County	Litchfield
Town	Winchester
River	Mad River, 2.3 river miles upstream from its confluence with Still River in Winsted, Connecticut

Distance from Winsted City Line	0.3 miles, west
Hartford, Connecticut	24 airline miles, northwest
Waterbury, Connecticut	26 airline miles, north
Connecticut River	63.1 river miles

3. Drainage Areas. Square Miles

Mad River at Dam Site	18.2
Mad River at Gaging Station	18.4
Mad River at mouth, confluence with Still River	33.3
Still River at mouth, confluence with Farmington River	86.6
Farmington River at mouth, confluence with Connecticut River	602.0

4. Stream Flow.

Record of U. S. G. S. Gaging Station, on Mad River near Winsted, October 1956-September 1958

<u>Time</u>	<u>c.f.s.</u>
Average annual	25.8
Maximum year (1958)	36.4
Minimum year (1957)	15.1
Maximum month (April 1958)	148.0

4. Stream Flow (cont'd)

<u>Time</u>	<u>c.f.s.</u>
Minimum month (August 1957)	0.9
Maximum day (December 21, 1957)	497
Minimum day (June 26, 1957)	0.3

5. Maximum Floods of Record

Record of U. S. G. S. Gaging Station, on Mad River near Winsted, Connecticut

<u>Time</u>	<u>c.f.s.</u>
August 1955	(est) 10,200
September 1938	(est) 2,200
October 1955	(est) 3,000
March 1959	1,420
December 1957	685
February 1959	585

6. Criteria for Spillway Design Flood

Peak inflow, to reservoir, c.f.s.	30,000
Total volume of rainfall, inches	24.0
Infiltration rate, inches per hour	.05
Total volume of runoff, acre-feet	22,100
Total volume of runoff, inches	22.8
Duration of flood, hours	36
Reservoir stage at start of flood, ft., m.s.l.	959
Outlet (6 inches storage initially utilized)	Inoperative

7. Reservoir Elevations, Areas and Capacities

Town affected
Winchester

<u>Pool</u>	<u>Elevation ft. m.s.l.</u>	<u>Area Acres</u>	<u>Acre Feet</u>	<u>Inches on Drainage Area</u>
Permanent conservation	872.0	10	188	0.2
Spillway crest	983.0	188	9,700	10
Maximum Surcharge	991.0	210	11,300	11.6
Top of Dam	996.0	222	12,300	12.7

8. Dam

Type	Rolled fill, earth
Top width, feet	25
Maximum base width, feet	900
Maximum height, feet	178
Total length, feet	910
Slopes	1 on $2\frac{1}{2}$ upstream above El. 875.0 1 on $2\frac{1}{2}$ downstream
Freeboard above spillway design, flood height, ft.	5.0

Elevations (above mean sea level)

Top of dam	996.0
Base of dam (stream bed at center line)	818.0
Maximum surcharge (Spillway Design Flood)	991.0
Top flood control pool, spillway crest	983.0
Stream bed at downstream toe	810.0
Stream bed at upstream toe	835.0

9. Dike

Type	Rolled fill, earth
Top width, feet	25
Maximum base width, feet	335
Maximum height, feet	60
Total length, feet	2450
Slopes	1 on $2\frac{1}{2}$ upstream 1 on $2\frac{1}{2}$ downstream

10. Spillway

Type	Uncontrolled side channel, concrete overflow, L-shaped
Crest length, feet	340
Elevation of crest, feet, m.s.l.	983.0
Maximum head, feet (above spillway crest)	8.0
Maximum inflow from spillway design flood, c.f.s.	30,000
Spillway peak discharge, c.f.s.	29,500

11. Outlet Works

Type	Concrete conduit, circular
Size of conduit	4 feet diameter
Length of conduit, portal to portal	710 feet
Gates	None*
Elevation intake sill, feet above m.s.l.	855.0

12. Capacity of Outlet

Reservoir at spillway crest, c.f.s.	500
-------------------------------------	-----

13. Real Estate (Based on acquisition in fee)

Total to be acquired, acres	517
Classification, Acres	
Residential	23
Developable	35
Commercial & Industrial	2
Tillage	20
Woodlands	412
Roads	15
River	<u>10</u>
Total	517

Improvements	
Residence	23
Barns	3
Garages	10
Poultry Houses	5
Misc. Out-buildings	13
Commercial buildings	3
Commercial gas station	1
Cabins	5

14. <u>Relocations</u>	<u>Existing Mileage</u>	<u>Proposed Mileage</u>
a. Roads		
Highways	2.3	2.3
b. Utilities		
Electric Distribution		
Lines	1.8	1.9
Telephone Exchange		
Lines	1.8	1.9

*No flood control gates, gate in conservation weir only.

15. Principal Quantities

Common Excavation (including stripping)	165,000 c.y.
Borrow Excavation	1,890,000 c.y.
Rock Excavation	85,000 c.y.
Rock Excavation, borrow	88,000 c.y.
Embankment	
Rolled Embankment	1,240,000 c.y.
Gravel Bedding	77,000 c.y.
Rock Fill and Rock Slope Protection	156,000 c.y.
Rock Filter	16,800 c.y.
Concrete	5,700 c.y.
Cement	8,500 bbl.
Reinforcing Steel	180,000 lbs.

16. Estimated Project Costs (1960 Price Levels)

Federal Costs

Relocations (Highway and Utilities)	\$1,037,000
Reservoir	12,000
Dam and Appurtenant Structures	3,570,000
Road and Bridge	43,000
Grounds	12,000
Preauthorization Studies	18,000
Engineering and Design	408,000
Supervision and Administration	<u>400,000</u>

Total Estimated Federal Cost \$5,500,000

Non-Federal Costs

Lands and Damages \$ 645,000

Total Estimated Project Cost \$6,145,000

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
OFFICE OF THE DIVISION ENGINEER
WALTHAM 54, MASS.

FLOOD CONTROL PROJECT

MAD RIVER DAM AND RESERVOIR
MAD RIVER
CONNECTICUT RIVER BASIN
CONNECTICUT

DESIGN MEMORANDUM NO. 4
GENERAL DESIGN MEMORANDUM

4 March 1960

B. INTRODUCTION

1. Purpose. - The purpose of this memorandum is to furnish information, to present the general plan for the Mad River Dam and Reservoir Project, and to facilitate the preparation and review of detailed design memoranda, plans and specifications.

2. Scope. - This memorandum presents general data for the entire project on the components, functions, costs and benefits of the Mad River Dam and Reservoir Project. The data contained herein will be supplemented and expanded, as required, by supplement to this memorandum and by subsequent design memoranda. The sections on real estate requirements, on reservoir management and public use and on relocations are complete. No separate design memoranda on these subjects will be prepared.

C. AUTHORIZATION

3. Authorization. - The Mad River Project was authorized by the Flood Control Act approved 3 July 1958, Public Law 85-500 which reads in part as follows:

"The project for the Mad River Dam and Reservoir on the Mad River above Winsted, Connecticut, is hereby authorized substantially in accordance with the recommendations of the Chief of Engineers in House Document Numbered 137, Eighty-fifth Congress, at an estimated cost of \$5,430,000."

Full monetary authorization for the project was provided in this Act.

4. In House Document No. 137, the Chief of Engineers recommended "Further improvement of the Mad River, Farmington River Basin, Conn., to provide for the construction of an earth-fill dam 168 feet high and 1,040 feet long, at mile 2.2, at an estimated cost to the United States of \$5,430,000 for construction; generally in accordance with the plans of the division engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable; provided that responsible local interests give assurances satisfactory to the Secretary of the Army that they will (a) furnish without cost to the United States all lands, easements, and rights-of-way other than highway relocations necessary for construction of the project; (b) zone the channel through the damage areas to prevent further encroachments and to require removal and prevent replacement of obstructive or hazardous structures along the channel whenever they become obsolete; (c) hold and save the United States free from damages due to the construction works; and (d) maintain and operate the works after completion in accordance with regulations prescribed by the Secretary of the Army."

D. SELECTION OF SITE

5. Selection of Site. - There is an urgent need for flood control storage to afford the City of Winsted, Connecticut a reasonable degree of flood protection. Winsted, one of the principal damage centers in the Connecticut River Basin, is situated on the Mad River. The Mad River site is the most desirable site for flood control storage in the watershed of the Mad River. Alternate sites on Mad River are discussed in Section L, Paragraph 26.

E. INVESTIGATIONS

6. Previous Investigations. - An interim report on Review of Survey, Mad River Dam and Reservoir was submitted in June 1956, and published without appendices in House Document No. 137, 85th Congress, 1st Session. The preparation of the report was authorized by resolution of the Committee on Public Works of the United States Senate on 14 September 1955. The report provided for the construction of a flood control reservoir of 9,630 acre-feet capacity, equal to 10 inches of runoff, with spillway elevation 973. The site was located on the Mad River 2.2 miles above its confluence with the Still River.

7. Prior Reports. - Flood Control on the Farmington River and its tributaries has been considered in the following published reports on the Connecticut River Basin:

House Document No.	Congress	Session	Date	Remarks
412	74th	2d	1936	Survey report. Presented general plan for improvement of Connecticut River and tributaries. Recommended initial plan of 10 flood control reservoirs in Vermont and New Hampshire.
455	75th	2d	1937	Survey report. Proposed comprehensive plan of dikes and 20 reservoirs for flood control on the Connecticut River.
653	76th	3d	1940	First interim review report on the Connecticut River. Recommended modification of authorized project for protection by dikes and related works.
724	76th	3d	1940	Second interim review report on the Connecticut River. Recommended additional local works and 20 reservoirs for flood control with adaptations for future development of power. Local protection consisting of channel improvement and dam removal at Winsted was recommended.

8. Current Investigations. - Studies for the project plan utilized the basic data obtained for the previous investigations. Hydrologic studies were made to review the recommended reservoir capacity and to determine the spillway design flood and outlet requirements. The Design Memorandum on Hydrology and Hydraulic Analysis was prepared and submitted in draft to secure approval of spillway design flood and top of dam elevation. Necessary geological and soils investigations of foundation conditions and embankment materials were initiated. Potential sources of concrete aggregate in the vicinity of the site have been investigated and the results of previous tests reviewed. Appraisals of lands and damages in the reservoir and work areas have been made. Relocations of roads within the reservoir have been discussed with State highway officials and preliminary plans for relocations have been

prepared. The U. S. Bureau of Public Roads has written that the State Highway Department and Bureau of Public Roads are in agreement that there is no need for a highway across the dam. The U. S. Public Health Service was requested to ascertain the need for water supply storage for future domestic or industrial use and has reported that water supply will not be a consideration in the project. The U. S. Public Health Service has also been requested to report on mosquito control and stream pollution requirements. The U. S. Fish and Wildlife Service has investigated the fish and wildlife resources of the area. Revised area capacity curves have been prepared from aerial photographic and USGS surveys, checked and adjusted by reservoir cross-sections.

9. Public Hearings. - The Corps of Engineers has not held public hearings on the Mad River project.

10. The Subcommittee on Flood Control - Rivers and Harbors of the Committee of Public Works and a subcommittee of the Committee on Appropriations heard testimony regarding the project during hearings in the first session of the eighty-fifth Congress. During the hearings on the River, Harbor and Flood Control Act of 1957 by the Subcommittee on Flood Control - Rivers and Harbors of the Committee on Public Works, the Honorable Senator Prescott Bush and Congressman James T. Patterson of Connecticut on February 5 and February 7, 1957, respectively, requested authorization of the project.

At the hearings held from 28 March to 10 May 1957 by the Subcommittee on Appropriations, Mr. William Wise, Director of the State Water Commission of Connecticut and Mr. Emile Ryan, Chairman of the Winchester Flood and Erosion Control Board urged favorable congressional action. Statements by the Honorable Abraham Ribicoff, Governor of Connecticut, Mr. Robert T. Cahill, president of the Winsted Chamber of Commerce; and Mr. W. Vernon Davey, president of the Winsted Manufacturer's Association also requested authorization of the project. Honorable Prescott Bush and Congressman Patterson, Mr. Ryan and Mr. Cahill urged that the requirements of local cooperation be modified to eliminate the land cost to local interests.

11. The Connecticut State Highway Department held a public hearing for consideration of the proposed relocation of Route 44 on 9 February 1960. Several individuals opposed the proposed highway alignment on the grounds that it would take traffic away from the portion of Main Street in front of their business establishments. Others considered the crossing of Route 183 at grade hazardous and urged an overpass. One individual commented that Winsted had not suffered flood damage since 1955 and questioned the need of a dam. Several persons spoke favoring the construction of the dam.

F. LOCAL COOPERATION

12. The project is subject to the specific requirements of local cooperation required by House Document No. 137 which are as follows: "(a) furnish without cost to the United States all lands, easements, and rights-of-way other than highway relocations necessary for construction of the project; (b) zone the channel through the damage areas to prevent further encroachments and to require removal and prevent replacement of obstructive or hazardous structures along the channel whenever they become obsolete; (c) hold and save the United States free from damages due to the construction works; and (d) maintain and operate the works after completion in accordance with regulations prescribed by the Secretary of the Army".

13. The State of Connecticut has enacted legislation necessary to comply with the requirements for local cooperation. Preliminary assurances of local cooperation have been furnished and formal assurances are expected in the near future. The State Water Resources Board has established river lines along the Mad River and a portion of the Still River to require removal and prevent replacement of obstructive or hazardous structures along the channel whenever they become obsolete. The Water Resources Commission and State Highway Department are initiating surveys and appraisals as a preliminary to land acquisition.

G. LOCATION OF PROJECT AND TRIBUTARY AREA

14. Location of Dam and Reservoir. - The Mad River Dam site is located in northwestern Connecticut on the Mad River at the westerly side of the Connecticut River Basin. The dam site is about 0.3 mile upstream from the westerly limits of Winsted and about 2.2 miles above the confluence of the Mad and Still Rivers.

The relation of the proposed dam and reservoir with respect to the Farmington River Basin and to other flood control projects on the Farmington River Basin is shown on Plate No. 4-1. The reservoir map is shown as Plate No. 4-2.

15. Description of the Mad River Basin. - The Mad River Watershed is bounded on the west by the Housatonic watershed and on the south, east and north by other parts of the Still River Basin. The area tributary to the dam is roughly rectangular with a maximum length (in a northwest-southeast direction) of about 6 miles and a maximum width (in a northeast-southwest direction) of about 3.5 miles. The river falls about 560 feet from its source at Spaulding Pond to the dam site in a distance of about

7.2 miles. The watershed is hilly with scattered swamps and ponds in the valleys. The area is rural and dense woods cover the hills and part of the valleys.

H. RECOMMENDED PROJECT PLAN

16. Recommended Project Plan. - The recommended project plan provides for an earth fill dam 910 feet long and 178 feet maximum height. An L-shaped side channel spillway will be located in a rock cut on the northerly abutment with spillway crest at elevation 983.0. The reservoir outlet will consist of a 48-inch ungated conduit to be located along an abandoned railroad bed on the southerly bank. One state highway, U. S. Route 44, will be relocated for a total length of 2.3 miles. The structures, improvements and relocations are described in detail in paragraphs 30 through 40. The various structures and topography at the site are shown on Plate No. 4-3.

I. DEPARTURES FROM PROJECT DOCUMENT PLAN

17. Departures From Project Document Plan. - The recommended plan is essentially the same as the project document plan. The dam embankment has been rotated about the northerly abutment moving the center of the dam upstream about 170 feet. This provided a more economical embankment, spillway and outlet works area. The spillway crest has been raised 10 feet to elevation 983.0 providing 9700 acre-feet of storage equivalent to 10 inches of runoff, the amount authorized. This change was made after study of U. S. G. S. sheets, an aerial survey of the reservoir and comparison with reservoir cross-sections made for the purpose. The top of the dam has been raised 8 feet as the net result of the above change, an increase of freeboard from 3 feet to 5 feet and reduction of surcharge from 12 feet to 8 feet.

J. HYDROLOGY

18. Reservoir Capacity. - The authorized reservoir capacity of 10 inches has been reviewed and adopted. The determination is discussed in detail in Design Memorandum No. 1, Hydrology and Hydraulic Analysis.

19. Spillway Design Flood. - For spillway design, a storm was developed based on 90 percent of the probable maximum precipitation for 18 square miles or 100 percent of the probable maximum precipitation for 50 square miles. The total depth of rainfall over the basin above the dam site is 24.0 inches in 24 hours.

Losses, including infiltration, were assumed at the maximum rate of 0.05 inches per hour, producing a rainfall excess of 22.8 inches. The peak value of 30,000 c.f.s. for the adopted spillway design flood inflow was determined by applying the rainfall excess to an adopted spillway design flood 2-hour unit hydrograph. This spillway design flood was routed through the reservoir, assuming the reservoir initially had six inches of storage utilized and the ungated outlet was inoperative. The resulting spillway design flood outflow is 29,500 c.f.s. with a maximum water surface elevation of 991.0 feet, m.s.l., as shown on Plate No. 1-16 in Design Memorandum No. 1.

20. Freeboard. - With the top of dam at elevation 996.0 feet, m.s.l., a freeboard of 5.0 feet above the maximum pool elevation of 991.0 feet, m.s.l., is provided.

21. Outlet Capacity. - The size of the outlet for Mad River Dam was selected so that the discharge through the conduit with the reservoir about 85 percent full, will equal the downstream channel capacity, i.e., 500 c.f.s. This capacity will be sufficiently restrictive to use effectively the reservoir storage, yet large enough to empty the reservoir within a reasonable time. The outlet being ungated, will operate automatically.

K. GEOLOGY

22. General. - The Mad River occupies a pre-glacial valley in the crystalline rocks of the Western Highland of Connecticut. Throughout most of its course the river flows in a deep, narrow, steep-sided valley but along the upper reaches of the river, the valley broadens locally to form flat, wide-bottomed, swampy plains. Throughout the steep, narrow reaches, the river flows on or close to bedrock with numerous boulders and bedrock outcrops forming small falls and rapids. The river meanders or is partly ponded in the wide, swampy sections of the valley which are underlain by generally thin or scattered deposits of glacial outwash.

23. Site Geology. - At the dam site, bedrock, consisting mainly of gneiss with some schist and granite, rises steeply in both abutments from the narrow valley bottom and is exposed or available at relatively shallow depths. Bedrock is also exposed or occurs at shallow depths in the spillway and spillway discharge channel area including the stream bed downstream of the end of the spillway channel. Extending upstream along the crest of the ridge which forms the northerly abutment of the dam and the foundation for the low portion of the dike near the spillway,

bedrock occurs at shallow to moderate depths. On the northern flank of the ridge and in the wide saddle closed by the higher portion of the dike, bedrock is generally deeply buried except at the north abutment of the dike where the bedrock rises to shallow depths or is exposed on the steep hillside.

24. The overburden is variable glacial till with numerous boulders which occur both scattered and in local concentrations. Surface concentrations of boulders form practically a boulder pavement on the southerly abutment of the dam. Waste rock from existing highway and abandoned railroad excavations covers the lower slopes of both abutments adjacent to the river.

25. The surface of the bedrock is very irregular with ribs and knobs of rock between till and boulder-filled troughs and pockets. The gneiss and schist are finely foliated and closely jointed. Weathering has occurred to moderate depths along numerous joints and seams. Although the general trend of the bedrock structure is approximately north-south or parallel to the axis of the dam, with very steep to vertical dips, locally, the direction and dip of the foliation is exceedingly variable and erratic throughout the area.

L. OTHER PLANS INVESTIGATED

26. Other Sites Investigated. - A possible site about 1 mile above the recommended site would flood the Rugg Brook water supply of the City of Winsted. In addition, the drainage area would be about 0.6 square miles less and the dam would be slightly less effective for reducing flood flows. Although a dam at this site would not be as high as at the recommended site, the basin is broader and the reservoir costs per acre-foot are about the same. No savings would result from a dam at this site.

Another site about 1,000 feet upstream of the recommended site was found to require a larger embankment volume with no compensating advantages in spillway or outlet works costs.

27. Type of Dam. - The site is suitable for concrete or rock fill construction. However, the rolled earth fill is more economical. Hydraulic fill is not feasible since the necessary pervious fill is not available within reasonable haul distances.

28. Spillway. - An ogee weir located in the left abutment with converging discharge channel would be feasible. However, it was found that the cost could be reduced with a side channel spillway and lower surcharge and that the ogee spillway and side channel are comparable only at higher surcharges.

29. Spillway Length, Channel Width and Surcharge. - Studies were made to determine the economic spillway length and surcharge and width of spillway channel, giving consideration to the cost of embankment, outlet works, real estate, highway relocation, spillway rock excavation and weir and lining concrete. Spillway length-surcharge-cost curves were developed for spillway lengths varying from 190 feet with 12-foot surcharge as used for preliminary estimates to 410 feet with 7-foot surcharge. The most economical surcharge was found to be 8 to 9 feet with corresponding spillway lengths of 285 and 340 feet, respectively.

Since there was no appreciable difference in cost the 8-foot surcharge was adopted to keep the grade on the relocated highway as low as possible.

Varying the width of channel between 30 and 50 feet had but little effect on the cost. A 40-foot width was adopted as the minimum practicable for ease and economy of construction.

M. DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

30. General. - The Mad River Dam and Reservoir Project will consist of a rolled fill earth dam and dike, both with rock slope protection; an L-shaped side channel spillway in rock in the north abutment of the dam and ungated outlet works consisting of a conduit under the dam. Access to the top of the dam will be by means of the road on the top of the dike and bridge crossing the spillway channel.

31. Earth Dam. - The project plan provides for construction of a rolled fill earth dam approximately 910 feet long with a maximum height of 178 feet above stream bed at center line of dam. The crest will be 25 feet wide accommodating a paved access road. The top elevation is 996.0 m.s.l. providing for 8.0 feet of spillway surcharge and 5.0 feet of freeboard. The dam will be mainly composed of compacted non-plastic silty sand (sandy glacial till) with either a pervious wick or an upstream zone of very impervious glacial till depending upon the availability and characteristics of suitable borrow materials. The downstream toe will be composed of a rock fill section placed on bedrock. A pervious drain will be placed on the bedrock extending under the earth fill from the downstream rock toe. The upstream toe below elevation 875 will be composed of the rock fill cofferdam. Some adjustments will be made in the downstream portion of the section on the right abutment, if subsurface explorations show the overburden to be thicker than now expected. The embankment will have side slopes of 1 on 2.5 both downstream and upstream,

except where the cofferdam forms the upstream toe section. The upstream slope of the rock portion of the cofferdam will be a natural dumped rock slope which will be covered with random fill with variable outer slopes depending upon placement conditions. A 12-foot wide berm on the rock fill toe on the upstream slope at elevation 875.0 will provide access to the trash structure on the inlet end of the conduit. Above elevation 875.0 the upstream slope will be faced with four feet of rock slope protection on two feet of gravel bedding. The downstream slope will be faced with two feet of rock slope protection on two feet of gravel bedding. The above described dam section is considered as tentative pending completion of all subsurface explorations and soil testing. Embankment profile and tentative cross-section are shown on Plate No. 4-4.

32. Earth Dam Design. - The dam embankment design is influenced by foundation conditions, the availability and characteristics of borrow material and the utilization of required excavation. To obtain the most economical section use of pervious materials will be held to a minimum. Outside embankment slopes have been tentatively established on the basis of other designs using similar materials. Details of embankment will be included in the design memorandum on embankments and foundations. Seepage through the embankment will be controlled by arrangement of zones with different relative permeabilities. Seepage through the bedrock foundation will be controlled near the toe of the structure by the large rock toe and the interior pervious drain both of which will be in contact with the bedrock.

33. Earth Dike. - A rolled fill earth dike approximately 2,450 feet long with a maximum height of 60 feet is required to close two saddles between the dam and the extreme northerly abutment. The dike will be mainly composed of compacted non-plastic silty sand (sandy glacial till with 25 to 40 percent silt) with a downstream drain at the elevation of the natural ground and a layer of gravel bedding, 4 feet in thickness, below elevation 980 on the downstream slope. The toe of the southern reach of the dike, where the height is less than 34 feet, will be a berm section 100 feet wide with a top elevation of 980.0 composed of uncompacted stripping materials. In the other reach of the dike, there will be a foundation drain beneath the toe consisting of pervious sand placed mainly in water. The slopes will be covered with rock slope protection on gravel bedding. The top width and elevation, the upstream slope and the downstream slope above the berm section all correspond to those of the dam.

34. Dike Embankment Design. - Dike embankment design is influenced by foundation conditions, the availability and characteristics of borrow material and the utilization of required excavation. To obtain the most economical section, available excavation and nearby borrow materials from Area A will be utilized to the maximum extent. Seepage through the embankment will be controlled by the foundation pervious drain and the relatively thick gravel bedding layer on the downstream slope. A downstream spoil toe 100 feet in width has been tentatively included in the portion of the dike nearest the spillway to insure satisfactory control of foundation seepage. A foundation drain is provided at the downstream toe of dike where the height exceeds 15 feet and the spoil blanket is not provided. This foundation drain will extend to bedrock or a depth of 15 feet to insure satisfactory control of seepage through the foundation rock and through the variable glacial till mantle. The tentative dike section is shown on Plate No. 4-4.

35. Spillway. - The spillway will be an L-shaped side channel spillway located on a rock knoll on the left abutment of the dam. The weir will be a low concrete ogee section founded on bedrock and 340 feet in length at the spillway crest elevation of 983.0 feet above mean sea level. The weir will be ten feet in height. At the weir a concrete lining 2 feet thick varying from 7.9 feet to 25.4 feet in height will be provided. A ten-foot wide apron will be placed at the bottom of the channel adjacent to the lining. The maximum elevation of the approach channel will be 978 feet above mean sea level at the upstream face of the spillway weir and the channel will have a 2% slope into the reservoir for drainage. The discharge channel will be 40 feet wide for its full length of about 1200 feet. All rock excavated from the spillway channel will be used in the dam. The spillway will have concrete training walls with a top elevation of 995 feet above mean sea level adjacent to the end of the dam. At the end near the dike a short section of concrete lining and low gravity wall will be provided. Details of the spillway shown on Plate No. 4-5 will be reviewed and further developed for the final submission of the design memoranda on hydrology and hydraulic analysis and detailed design of structures.

36. Outlet Works. - The outlet works is located partially in an abandoned railroad cut in the right abutment and consists of a single 4'-0" diameter ungated conduit founded on bedrock. Details are shown on Plate No. 4-6. The intake will consist of a conservation weir with crest at elevation 872.0 m.s.l. A trash structure will be provided over the weir. A 5-foot by 5-foot hand operated slide gate is provided for use during diversion and to permit partial unwatering of the conservation pool. Approach channel excavated in rock and earth and inlet sill are at elevation 855.0, 20 feet above the upstream toe of the dam. To control floating trash, a log boom will be provided upstream from the intake channel. Details of the outlet works will be more fully developed and presented in the design memoranda on hydrology and hydraulic analysis detailed design of structures.

37. Diversion Plan. - The plan of diversion is controlled by the necessity of preparing the embankment foundation and placing the earth embankment in the stream bed in the dry. The first stage construction includes construction of portions of the dikes, constructing the outlet conduit and lower portion of the conservation weir and preparing the rock fill cofferdam site. The second stage operations include diverting the river through the outlet works by completing the cofferdam, dewatering the embankment area, and preparing the foundation in the stream bed. The third stage operations include filling the river channel and old railroad cut, leaving the left side of the dam low so that the highway gap may serve as an emergency spillway gap during construction, then bringing the entire embankment up as rapidly as possible.

Two other stages, utilizing the saddles closed by the dikes, as emergency spillway gaps during construction, will be considered in the development of design memorandum on embankments and soils. The construction of the spillway weir will complete the final stage.

The first stage will be accomplished during the second construction season, the second stage either in the late summer and early fall of the second season or early in the third season. The spillway weir will be placed early in the fourth season.

38. Reservoir Clearing. - It is planned to clear the portion of the reservoir below elevation 877 which is five feet above the level of the permanent pool. The area at this elevation is 13 acres of which about 8 are wooded.

39. Staff and Recording Gages. - A series of staff gages and a recording gage of the bubbler type will be provided for reading and recording reservoir stages.

40. Administrative Facilities and Utilities. - No administrative facilities or utilities are provided at this time. It is expected that maintenance will be accomplished by the State of Connecticut using a small mobile group operating from a separate headquarters.

N. ACCESS ROADS AND RAILROAD FACILITIES

41. Highways. - The site is located on U. S. Route 44, a 20-foot paved concrete road which follows Mad River through the reservoir. Upon completion of relocations, reconstructed Route 44 will be adjacent to the end of the dike and will serve as the main access road. Access will be limited to official use only.

Access to the reservoir area will be via existing Route 44 which will be provided with access to new Route 44.

42. Railroad Facilities. - The New York, New Haven and Hartford Railroad serves Winsted which is the nearest railroad freight station. No investigation of facilities for unloading has been made.

O. USE OF CONSULTANTS

43. Use of Consultants. - The Mad River Dam imposes no complex design problems. Copies of this memorandum, however, will be forwarded to Mr. Arthur Casagrande and Mr. Frank Fahlquist, Consulting Engineers, both of whom are retained by this office on a continuing basis, for their review and comment.

P. SOURCES OF CONSTRUCTION MATERIALS

44. General. - The glacial till overburden is generally very thin in the Mad River area and there is also a relative scarcity of significant outwash deposits of pervious materials in undeveloped parts of the region. Location of materials suitable for construction of earth fills at the site is an important problem and exploration is still in progress to locate and define the limits of areas where adequate quantities of the various types of required materials can be obtained. Available materials will be further covered in the design memoranda on site geology and embankments and foundations. To obtain a material which is more impervious than the materials locally available would probably require a haul of as much as 10 miles.

45. Random, Semi-impervious and Impervious Material. - An extensive area on the north side of the ridge forming the left abutment of the dam, designated Area A (see Plate No. 1-2), contains a large quantity of sandy glacial till. This material is characteristically variable but consists generally of relatively semi-impervious to impervious, gravelly, silty sand with numerous cobbles and boulders. This is the most impervious material encountered in the area to date. Largely because of the irregular configuration of the underlying bedrock, the thickness of the deposit is variable ranging from stripping depth up to approximately 25 feet.

46. In Area D (see Plate No. 1-2), located in and adjacent to the low saddle between Crystal Lake and Mad River approximately one-half mile upstream from the right abutment of the dam, exploration to date indicated that a thick and extensive deposit of variable, sandy till is available. The material consists generally of relatively semi-impervious, gravelly, silty sand and silty, sandy gravel with numerous cobbles and boulders similar to the material in Area A.

47. Areas B and C located in the reservoir one mile and one-half mile, respectively, upstream from the dam (see Plate No. 1-2), contain shallow to moderately thick, very variable deposits consisting of limited quantities of relatively pervious sandy gravel and gravelly sand generally overlying semi-pervious to semi-impervious silty, gravelly sand and silty sandy gravel with cobbles and boulders. These materials will be utilized in appropriate sections of the embankments.

48. Pervious Materials. - An extensive area of glacial outwash deposits occurs in the vicinity of Grantville, Connecticut, approximately 4 miles upstream from the dam site, (See Plate No. 1-1.). Examination of existing exposed pits in the area indicates that the material consists mainly of sand with gravelly phases. Explorations are planned to better determine the character and quantity of usable material from this source.

49. Very extensive deposits of outwash sand and gravel are available in the Still River valley both northward and southward from Winsted, Connecticut, which is approximately $1\frac{1}{2}$ miles east of the dam site. Many of these deposits have already been developed commercially and could, if necessary, furnish required quantities of pervious materials and gravel bedding.

50. Consideration is at present being given to the possibility of obtaining material for gravel backing from channel improvement work in the valley of the West Branch of the Farmington River at New Hartford, Connecticut, and Riverton, Connecticut, approximately 9 and 6 miles, respectively, from the dam site. The materials which would be removed to improve the channel occur in gravel bars and flood plain deposits in and adjacent to the present channel.

51. Rock Fill. A large part of the requirement for rock for slope protection and rock fill will be obtained from structure excavations in bedrock at the dam site. The rock consists of gneiss, schist and granite which are relatively hard and durable but because of foliation and jointing, elongated, slabby shapes will tend to predominate.

52. If additional rock beyond that obtained from structure excavations at the site is required, arrangements can probably be made to utilize stock-piled waste rock from rock excavations for the highway relocation which will be constructed under a separate contract. A quantity of rock fill could also be obtained by utilizing boulders from required excavations including stripping operations at the site. If necessary, additional rock can be obtained by quarrying.

53. Concrete Aggregates. a. General. - The quantity of concrete required in the construction of spillway and outlet works structures is approximately 5,700 cubic yards. With this relatively small quantity, aggregate investigations have been limited to commercial sources within a 25-mile radius of the site.

b. Nearest Source. - The nearest commercial source of concrete aggregates is Building Materials, Inc., with main operating pit and processing plant located in Torrington, Connecticut, - about 10 miles haul distance from the dam site. Aggregates from this source were tested in January 1957 by SADL and were used in the construction of Local Protection Facilities at Torrington, Connecticut. They are currently being used in the construction of Thomaston Dam, on the Naugatuck River, Connecticut.

c. Other Sources. - Two other commercial sources, Dunning Sand and Gravel Co. and Arborio and Sons, Inc., with main operating pits and processing plants located in Farmington, Connecticut, are approximately 22 miles haul distance from the site. Materials from these sources were tested and approved for Folly Brook, Local Protection Project and Mansfield Hollow Dam respectively. More complete information on concrete aggregates will be included in Design Memorandum No.3, "Concrete Materials".

Q. RESERVOIR MANAGEMENT AND PUBLIC USE

54. Recreation. The construction of Mad River Dam, with the inclusion of the ten acre permanent pool, will provide a desirable area for public recreation. The project is located in the north central part of the state and a total of twenty-one communities lie within a ten-mile radius of the project. About 58,000 people live within this area at the present time and, at the current rate of growth, the population is expected to reach 65,000 by the year 1970. Although there are five state parks and five state forests within ten miles of the project only one, Burr Pond State Park, offers public swimming and boating. The Director of the Water Resources Commission of the State of Connecticut and the Executive Director of the Farmington River Watershed Association advise of the need and desire for additional public recreational waters in the area. The Mayor of Winsted who is also First Selectman of the Town of Winchester states that the proposed pool would relieve an existing overload of public facilities at nearby Highland Lake. The State and Federal Fish and Game authorities note that the proposed pool should provide excellent trout habitat. Because of the proximity of the pool to the City of Winsted, they anticipate high interest and heavy pressure. Consequently, they plan to carry out a relatively heavy stocking program to satisfy the known enthusiasm for fishing exhibited by residents of surrounding areas. There are 8,280 licensed sportsmen living within a ten-mile radius of the project whose recreational demand is estimated to exceed 41,000 days afield annually.

Existing Route No. 44 and the so-called "Old Norfolk Road" can provide ready access through the reservoir to the pool area.

Consideration to the above public recreational possibilities is being given by the Water Resources Commission of the State. Use of the reservoir area for recreational purposes will be controlled by the State of Connecticut, since the authorizing document requires that all lands and easements be furnished by non-Federal interests. Hence, no provision of basic recreational facilities by the Corps of Engineers is proposed other than features which can be incidentally incorporated in the dam construction.

At elevation 872.0 m.s.l., the permanent pool would have a surface area of ten (10) acres, an average depth of 18.8 feet and would contain 188 acre-feet of water. It would extend about 2100 feet upstream from the dam with an average width of about 250 feet.

R. REAL ESTATE

55. General. - The acquisition of land for the Mad River Dam and Reservoir Project will be made in accordance with the project authorization. Acquisition of land for this project will be the responsibility of local interests, namely, the Connecticut Water Resources Commission and State of Connecticut Highway Department. These agencies are considering the acquisition of all lands required in fee. Pending a definite determination in this matter, land acquisition cost estimates for purposes of this report are based on the criteria, policies and procedures expressed in EM 405-2-150, dated 1 October 1958, subject "Joint Policy - Land Acquisition Reservoir Projects" Department of the Interior - Department of the Army.

Inasmuch as the land over which flowage easements will be acquired under the above criteria will have little residual value subsequent to the imposition of the easement, real estate costs are also shown for the acquisition in fee of all land required.

56. Area Description. - The Mad River Dam and Reservoir Project located in the Farmington River Basin is wholly within the town of Winchester, County of Litchfield, State of Connecticut. The Dam will be located across U.S. Route #44 approximately 1 mile west of the City of Winsted. The reservoir will extend up river on the Mad River for a distance of about 2 miles.

The general project area consists of woodland, pastureland, tillable lands, homesites, potential homesites, commercial and industrial sites. The area is suburban and rural in character. There are a few commercial establishments such as a combination gasoline service station, and overnight cabins, and a small road side stand, a commercial garage and a small industrial establishment. The residences for the most part are of the older type occupied by owners in the middle income group with the exception of a few small low value homes. The farm units to be affected are operated on a part-time basis and do not appear to be economical operations. There are no municipal buildings located within the taking areas.

57. Relocations. - A portion of U.S. Route #44 will be relocated and estimated costs for 78 acres of land for this purpose are included in this report. The subject area consists of woodland, homesites, and potentially developable road frontages.

No cemeteries have been found within the area of the proposed project.

There are no gas pipelines or electrical transmission lines within the area to be acquired.

58. Land Acquisition Requirements. - The total area to be acquired consists of 517 acres based on a guide taking line established at elevation 992' m.s.l. Of the 517 acres, fee simple interests would be required over 455 acres for the dam-site, construction areas, permanent structures, reservoir land subject to a five-year flood frequency, and for land required to relocate U.S. Route #44. Suitable flowage easements would be required over 62 acres of land which are above the five-year flood frequency.

59. Severance Damages. - Severance damage is expected to occur where partial takings are made. Damage of this nature will be attributable to:

(1) Loss in value to remaining lands due to a limited or difficult access.

(2) Loss in value due to the distortion in shape and plottage of remaining areas.

(3) Loss in value due to the reduction in the highest and the best use of the remainder.

Severance damage is estimated at \$ 40,000 based on recent acquisition experience of the Corps of Engineers for projects of this type. Individual property maps and tract data are not available for purposes of arriving at these estimates. No consideration has been given to severance damages occasioned by the construction of U.S. Route #44 as a non-access highway. Any such damages are considered as a betterment and apart from project purposes.

60. Minerals. - No mining operations were observed within the project area.

61. Water Rights. - None noted.

62. Resettlement Costs. - Resettlement costs are estimated and based on current experience by this office in other nearby reservoir projects and are as follows:

22 Residential Units @ \$600.	=	\$ 13,200.
1 Commercial unit @ \$2500.	=	2,500

Resettlement Costs (cont'd)

2 Agricultural Units	@	\$ 1,000.	=	\$ 2,000.
1 Industrial Unit	@	1,000.	=	1,000.
Processing 27 claims	@	75.	=	<u>2,025.</u>

\$ 20,725.

Rounded to \$ 21,000.

63. Acquisition Costs. - The acquisition costs are estimated and based on current experience by this office in nearby reservoir projects.

100 tracts @ \$ 1,000. = \$ 100,000.

In the event that all lands are acquired in fee, duplication of tracts on which both fee and easement would be acquired is eliminated. This reduces the number of tracts to 70, thus reducing the acquisition costs.

Acquisition in fee only

70 tracts @ \$ 1,000. = \$ 70,000.

64. Valuation. - The values estimated in this report are based on a study of recent sales of similar properties located within the vicinity of the proposed project.

The total Real Estate Costs will be set forth under two separate premises and indicated as follows:

Premise No. 1 is predicated upon the assumption that lands will be acquired under a combination of interests of fee simple and flowage easements.

Premise No. 2 is predicated upon the assumption that all lands required will be acquired in fee simple.

LAND:

Fee Area

<u>Acres</u>	<u>Classification</u>	<u>Average Unit Value</u>	<u>Estimated Value</u>
22	Residential	\$ 3,000.	\$66,000.
25	Developable	2,000.	50,000.
1	Commercial & Industrial	4,000.	4,000.
20	Tillage	200.	4,000.
362	Woodlands	50.	18,100.
15	Roads	-	-
10	River	-	-
<u>455</u>			<u></u>

Rounded to

\$ 142,100.
\$ 142,000.

\$142,000.

IMPROVEMENTS

22 Residences	\$196,000.
2 Barns	2,000.
9 Garages	11,900.
5 Poultry Houses	900.
11 Misc. Out-bldgs.	4,800.
3 Commercial bldgs.	13,300.
	<u>\$228,900.</u>

Rounded to \$229,000.

\$371,000.

LAND

Flowage Easement Area - Fee Value Before Encumbrance. -

<u>Acres</u>	<u>Classification</u>	<u>Average Unit Value</u>	<u>Estimated Value</u>
1	Residential	\$3,000.	\$ 3,000.
10	Developable	2,000.	20,000.
1	Commercial	4,000.	4,000.
<u>50</u>	<u>Woodland</u>	<u>50.</u>	<u>2,500.</u>

62 Acres

\$29,500.

IMPROVEMENTS

1 Residence	\$15,000.
1 Barn	3,000.
2 Misc. bldgs.	1,000.
1 Commercial gas station	25,000.
5 cabins	11,000.
1 garage	<u>100.</u>

\$55,100

Rounded to \$55,000.

\$84,500.

FEE VALUE AFTER IMPOSITION OF EASEMENTS

LAND

<u>Acres</u>	<u>Classification</u>	<u>Average Unit Value</u>	<u>Estimated Value</u>
1	Residential	\$50.	\$ 50.
10	Developable	50.	500.
1	Commercial	50.	50.
50	Woodland	25.	<u>1,250.</u>
			\$1,850.
			Rounded to \$2,000.

IMPROVEMENTS

None	TOTAL	\$2,000.
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VALUE OF FLOWAGE EASEMENTS

Value Before Easement Imposition	\$ 84,500.
Value After Easement Imposition	<u>2,000.</u>
	<u>\$ 82,500</u>

COST SUMMARY

Premise #1

1. Fee title to 455 acres of Land	\$142,000.
2. Improvements in Fee area	229,000.
3. Flowage Easements over 62 acres of land	27,500.
4. Improvements in Easement Area	55,000.
5. Minerals	None
6. Severance Damages	40,000.
7. Resettlement Costs	21,000.
8. Acquisition Costs	<u>100,000.</u>
	\$614,500.
Contingency (10% of \$614,500.)	<u>61,450.</u>
	\$675,950.
Total Real Estate Cost Rounded to	\$676,000.

COST SUMMARY

Premise #2

1. Fee Title to 517 acres of Land	\$171,500.
2. Improvements	284,000.
3. Minerals	None
4. Severance Damage	40,000.
5. Resettlement Costs	21,000.
6. Acquisition Costs	<u>70,000</u>
	\$586,500.
Contingency (10% of \$586,500)	<u>58,650.</u>
Total Real Estate Costs	\$644,150.
Rounded	\$645,000.

It very apparently would be in the best interests of the State to acquire fee title to all land below guide taking line. It would give the various interests more flexibility in planning future uses of the area.

In view of the reduction in cost for acquisition of fee title, this office would have recommended acquisition of all lands in fee. Consequently, the lesser amount has been included in the project estimate.

S. HIGHWAY RELOCATIONS

65. General. - One major highway, U.S. Route #44, extends in northwesterly direction from the dam site to the upper reaches of the reservoir area. This highway will be relocated with a minimum elevation of edge of pavement, within the reservoir area, of Elev. 987.1 m.s.l., 4.1 feet above spillway crest elevation, which represents a level approximately 4 feet above a recurrence of the August 1955 maximum flood of record with the Mad River Dam being in operation. Minimum elevation at the crossing of the dike will be Elev. 996.0 m.s.l., elevation of the top of dike.

Three local roads located entirely within the reservoir area will be abandoned. One local road located mostly within the reservoir area, and with no connection to other roads outside the reservoir area, will also be abandoned. A flowage easement will be obtained on a short section of one lightly travelled local road, within the reservoir area, as a connection to roads outside the reservoir area is available for use during periods of major floods.

66. Identification. - Each road or section of a road within the reservoir area, where some modification will be required, is identified by a number which is shown on Plate Number 4 - 7 and corresponds to the description in this report bearing the same identification number.

67. Traffic Counts. - Traffic Counts on U.S. Route 44 and State Highway Route 183, made by the Connecticut State Highway Department in 1959, and estimated traffic volumes on the town roads, are given in the pertinent paragraphs of this memorandum.

68. Relocations Agreement. - Type of Contract. - Officials of the Connecticut State Highway Department have indicated that they will perform all engineering work required for the relocation of U.S. Route 44 and prefer to award and supervise the road construction contract under a cost reimbursable relocations agreement rather than under a lump sum agreement. No expenditures are proposed for town road relocations. The Selectmen of Winchester have indicated that they are willing to grant a flowage easement for infrequent flooding of Rugg Brook Road, the only town road to remain within the reservoir area.

69. State Highways. - U.S. Route 44. - This important highway is on the Federal Aid Primary System and connects the capital city of Hartford with the cities and towns in the northwestern part of Connecticut and the State of New York. It crosses the Mad River dam site about 0.3 of a mile westerly from the city limits of Winsted and follows the general northwesterly direction of Mad River within the reservoir area. There are two crossings of Mad River within this stretch. The one nearest the dam site is a concrete T beam bridge with composite reinforced concrete deck. There are no sidewalks. This bridge was constructed in 1940 and is in good condition. It has a roadway width of 36 feet, a clear span of 41.5 feet, and elevation above river bed of 24 feet.

The next bridge upstream over Mad River was also constructed in 1940 and is maintained in good condition. It is constructed of encased I beams with a reinforced concrete deck. The 8" reinforced concrete roadway is constructed over a 12" gravel base with 7' gravel shoulders on each side making a total width between curbs of 36 feet. This bridge has a clear span of 48'-2" and elevation above river bed of 20 feet.

The reinforced concrete T-beam bridge crossing Mill Brook is located just outside the northerly edge of the reservoir area. This bridge, constructed in 1934 and widened in 1940 is in very good condition. It has a 36' roadway, a clear span of 27', and elevation above river bed of 9 feet. No changes to this bridge structure are proposed. However, this structure was flooded during the August 1955 Flood and channel improvements for

a distance of about 100 feet each side of the bridge are recommended to be included as part of the road relocations contract. It is considered that removal of boulders and debris from this area would be sufficient to prevent future flooding of this bridge.

The bridge crossing Indian Meadow Brook, below the dam, is constructed of encased I beams with a reinforced concrete deck. This bridge has a clear span of 40 feet with a roadway width of 37 feet and one sidewalk 5 feet wide. No changes to this bridge structure are proposed.

Traffic counts made on U.S. Route 44 near the dam site by the State of Connecticut in 1959 show the ADT volume to be 3500 vehicles.

U. S. Route 44 is a 2-lane reinforced concrete highway 22' wide, 8" thick over 12" gravel base with 8' bituminous treated rolled gravel shoulders 4" thick over 12" gravel base. It is maintained in very good condition.

About 6600 feet of this highway, with the two bridge structure crossing Mad River, as shown on Plate No. 4-7, Identification No. 1, will be abandoned as a State Highway but retained for use by the State of Connecticut in developing and maintaining recreation facilities within the reservoir area.

Relocation of U.S. Route 44 northeast of the reservoir area will be made for a distance of about 12,200 feet as shown on Plate No. 4-7, Identification No. 2, starting at a point just southeast of its intersection with Grant Station Road and continuing in a southeasterly direction to the point where it rejoins present U.S. Route 44 at its intersection with Upland Road. The Connecticut State Highway Department plans to continue construction from Upland Road southerly to Division Street, without Government participation, to provide a 2-lane width in each direction with flush median within the city limits. The section from Upland Road to Route 183, Coe Street, will be constructed with 4-travel lanes and a raised grass median strip. There will be no access driveways in this section. An overpass will be constructed over Route 183, which has an ADT volume of 1200 vehicles, with a west bound off ramp to Route 183. The section from Route 183, Coe Street, to the northerly junction with present U.S. Route 44 will be constructed as one barrel of a dual, no access highway with 8" reinforced concrete surface 24' wide and 10' shoulders constructed of 2½" bituminous concrete over 6" crushed stone base and 6" gravel sub-base. A reinforced concrete box culvert or steel stringer bridge with clear span of 40', depending upon which is the most economical, will be constructed across Indian Meadow Brook. A 6.5' x 6.5' reinforced concrete box culvert or 84" ACCM Pipe culvert will be installed at a brook crossing near the northwesterly end of the project.

Access to the dike will be provided from relocated U.S. Route 44 for official use only in order that local officials may maintain the structures and outlet works. Locked gates will be provided to prevent unauthorized access at this location.

Government participation in cost of the relocation of U.S. Route 44 will be limited to "replacement-in-kind" on the most economical location and alignment conforming to modern design standards for safety from the junction of Upland Road and present U.S. Route 44 to the northwesterly terminus of the relocation. Such cost shall be determined by multiplying the estimated quantities for the "replacement-in-kind" highway by the unit prices bid by the lowest responsible bidder on the highway to be constructed. Engineering costs for design and construction to be borne by the Government shall be determined on a pro rata basis. All real estate costs shall be borne by the State of Connecticut as prescribed in the Authorization Act.

Alternate relocations for U.S. Route 44 were studied to find the most economical alignment.

A relocation southwesterly of the reservoir area would require two crossings of Mad River, a substantial increase in property damage at the southerly end and a large increase in rock and earth quantities due to the rugged terrain.

Reconstruction of a short section of Route 183, which is a waterbound macadam road constructed in 1917 and subsequently widened to variable widths of 22'-30' with bituminous surface treatments to carry traffic from both Route 183 and U.S. Route 44 was found to be impractical and less economical because the alignment, gradient, sight distances and roadway width are below state standards and would require very extensive land damages in a residential area.

70. Local Roads. - a. Rugg Brook Road is a town road with a 14'-22' bituminous treated gravel surface. The estimated ADT volume is 300 vehicles. It is used mainly as a service road for Rugg Brook Reservoir as there are no residences in the watershed of the Rugg Brook Reservoir. It serves one residence outside the northwesterly limits of the Mad River reservoir area. A section of this road about 400' long, as shown on Plate No. 4- 7, Identification No. 3, crosses the reservoir area westerly from its junction with U.S. Route 44. The lowest point in elevation is the top of the new prestressed concrete beam and slab bridge over Mad River, Elev. 971 m.s.l., which is 12' below spillway crest elevation. This bridge has a surface width of 22', a span of 51', elevation above river bed of 10 feet, and is considered adequate to take major flood flows. The frequency of flooding

of the top of bridge would be about once in 75 years, which might also occur without the Mad River Dam having been constructed. A flowage easement will be acquired on this section of road. The remaining house on the westerly side of the Mad River Reservoir Area will have an escape route during periods of major flood over Rugg Brook Road and connecting roads to the southwest.

b. Rattle Valley Road is a 16' bituminous treated gravel town road in good condition which leads from U.S. Route 44 southerly to a point 700' outside the reservoir area, where it dead ends. It serves three residences within the Mad River reservoir area and one outside. The estimated ADT volume is 50 vehicles. This road about 2500' in length, as shown on Plate No. 4-7, Identification No. 4, will be abandoned. The residence located outside the Mad River Reservoir area will be acquired, as local officials of the Town of Winchester will not permit an access road to be constructed over an old trail past Crystal Lake, which is used for water supply purposes.

c. Old Norfolk Road #1 is a 12' bituminous treated gravel town road, in good condition, formerly part of old U.S. Route 44, which is located entirely within the reservoir area. Estimated 1959 ADT volume is 10 vehicles. Its entire length of about 700', as shown on Plate No. 4 - 7, Identification No. 5, will be abandoned. A private road to a set of buildings starts at the easterly end of this road and crosses the Mad River over a steel plate girder bridge with wood deck, in very poor condition. Since the buildings are in the reservoir, the property will be acquired and the bridge removed.

d. Old Norfolk Road #2 is an 11' bituminous treated gravel town road, in good condition, formerly part of old U.S. Route 44, which is located entirely within the reservoir area. Estimated 1959 ADT volume is 10 vehicles. Its entire length of about 1300', as shown on Plate No. 4-7, Identification No. 6, will be abandoned.

e. Old Norfolk Road #3 is a 24' bituminous treated gravel town road, in good condition, formerly part of old U.S. Route 44, which is located entirely within the reservoir area. Its entire length of about 2200', as shown on Plate No. 4-7, Identification No. 7, will be abandoned.

71. Cost Estimates. - The estimated cost of the U.S. Route 44 relocation was computed from layout on current aerial survey maps, Scale 1" = 200' and contour interval of 5', as follows: -

<u>Highway</u>	<u>Length</u>	<u>Est. Construction Cost</u>
U.S. Route 44	2.3 miles	\$ 1,013,000

This estimate was based on average unit prices which have been bid on similar types of projects in the State of Connecticut during 1959 and include 15% for contingencies. Detailed cost estimate is shown in Table II starting on page 41.

72. Allocation of Costs. - The cost estimate in the preceding paragraph is the amount to be borne by the Government for a "replacement-in-kind". The additional cost for widenings and betterments, including all costs for land takings and damages, will be borne by the State of Connecticut.

73. Attitude of Local Officials - The plans for proposed highway relocations and modifications, as described herein, have been presented and discussed with officials of the Connecticut State Highway Department and Selectmen of the Town of Winchester, Connecticut. These authorities have indicated informally that they are in agreement with the proposed plans.

74. Attorney's Report. - The Attorney's Report is included as Appendix A following text of this design memorandum.

T. UTILITIES

75. Connecticut Light & Power Company. - The Connecticut Light & Power Co. owns, operates and maintains a single phase, 4800 volt distribution primary line along Route 44 through the reservoir area and dam site. There are also sections of 115/230 Volt secondary lines and service drops to buildings. The pole line is jointly occupied with the Southern New England Telephone Co. on a fifty percent ownership basis. Primary lines are carried both vertically and on crossarms on 35 foot and longer Class 4 treated southern pine poles. The Company's preliminary estimate of relocation cost is \$ 11,000. All work will be done by the Utility Company under a relocations agreement and coordinated with other work to be done in the area. Costs are computed by application of cost of new work, original cost, depreciation, cost of removal and salvage.

The existing #4 copper primary line extends for approximately 9,600 feet northwest along Route 44 from its intersection with Route 183, to its intersection with the Grant Station Road at the head of the reservoir area.

Construction of approximately 10,000 feet of new, jointly owned pole line and single phase primary along existing Route 183 and relocated Route 44, to the intersection of Route 44 with the Grant Station Road, will serve existing customers otherwise cutoff by removal of the line through the reservoir area.

76. Southern New England Telephone Co. - The Southern New England Telephone Company owns, operates and maintains an exchange cable and service drops to buildings along Route 44 through the reservoir area and dam site. The pole line is jointly occupied with the Connecticut Light & Power Co. on a fifty percent ownership basis.

The Company's preliminary estimate of relocation cost is \$13,000. All work will be done by the Utility Company under a relocation agreement and coordinated with other work to be done in the area. Costs are computed by application of cost of new work, original cost, depreciation, cost of removal and salvage.

The existing 50 pair cable extends for approximately 9,600 feet northwest along Route 44 from its intersection with Route 183 to its intersection with the Grant Station Road at the head of the reservoir area.

Construction of approximately 10,000 feet of new jointly owned pole lines and 50 pair cable along existing Route 183 and relocated Route 44 to the intersection of Route 44 with the Grant Station Road will serve existing customers otherwise cut off by removal of the line through the reservoir area.

77. Attorney's Report. - The attorney's report is included as Appendix A following the text of this Design Memorandum.

U. COST ESTIMATES

78. Cost Estimates. - The total estimated cost of the Mad River project is \$6,145,000. The cost to the United States for construction and highway and utility relocations is \$5,500,000 which is a net decrease of \$470,000 under the latest approved estimate. Cost to the State of Connecticut for lands and damages, including lands for highway relocations is estimated at \$645,000. The reduction in Federal cost is due to reduction in contingencies and refinement of design. Access road cost is revised to include the bridge over the spillway and the feature "Grounds" has been added. The total of the feature "Dam" was reduced. Local costs for lands and rights-of-way have increased substantially over the 1956 estimate of \$390,000 as given in House Document No. 137, the latest approved estimate. The increase is due to acquisition of highway right-of-way for future needs, necessity for obtaining much of the borrow from sources outside the reservoir, increased value of lands and improvements and acquisition of additional properties. A summary of the cost of the various features is given in Table I. Breakdown estimates are given in Table IV starting on Page 42.

TABLE I

SUMMARY OF FEDERAL COSTS
(February 1960 Price Level)

Engineering News Record Construction Cost Index 812.68 -
(1913 = 100)

<u>Project Feature</u>	<u>Cost</u>
Relocations (U. S. Route 44 and Utilities)	\$1,037,000
Reservoir	12,000
Dam (Embankment, Spillway and Outlet Works)	3,570,000
Road and Bridge	43,000
Grounds	12,000
Preauthorization Studies	18,000
Engineering and Design	408,000
Supervision and Administration	<u>400,000</u>
	\$5,500,000

V. SCHEDULES FOR DESIGN AND CONSTRUCTION

79. Design. - Preparation of plans and specifications for U. S. Route #44 will be completed by the Connecticut State Highway Department in Fiscal Year 1960. Preparation of plans and specifications for the dam and appurtenant structures will be completed in the third quarter of Fiscal Year 1961.

80. Construction. - It is estimated that three and one-half construction seasons will be required for construction of the project. Contingent on the availability of the necessary funds, construction of the dam and appurtenances will be accomplished under a single continuing contract to be awarded in Fiscal Year 1961.

During the first (1960) construction season work will be initiated on the highway relocation. Since Route #44 passes through the dam site its relocation must be initiated early in the construction program to clear the work area for construction of the dam embankment. The work will be accomplished during the 1960 and 1961 construction seasons under an agreement with the Connecticut State Highway Department, which will administer the construction contract.

During the 1961 construction season the highway relocation will be completed. The contractor will construct the outlet works and portions of the dike. The cofferdam will be constructed and the river diverted late in the summer to take advantage of low stream flow. Constructing the upper part of the conservation weir and placing fill in the old railroad cut will be deferred. This will permit winter and spring flood flows to pass through the railroad cut without endangering the cofferdam.

During the 1962 construction season the contractor will complete the dam embankment, remaining portions of the dike and spillway rock excavation.

In the 1963 construction season the contractor will place the spillway lining and spillway weir, construct the access bridge over the spillway, access road pavement and will clean up the site.

Separate contracts for utility relocations will be negotiated with the utility companies in Fiscal Year 1961.

81. Funds Required. - The construction schedule is based on initial funding of \$268,000 in Fiscal Year 1960, and the assumption that additional funds will be appropriated as required. It is estimated that funds will be required by Fiscal Years approximately as follows:

<u>Fiscal Year</u>	<u>Construction Schedule</u> <u>Amount Required</u>
1961	\$ 870,000
1962	2,300,000
1963	1,890,000
1964	151,000
Sub-Total	<u>\$5,214,000</u>
Allotted to Date	<u>286,000*</u>
Total	\$5,500,000

*Includes \$18,000 for preauthorization studies.

W. RESERVOIR REGULATION

82. Reservoir Regulation. - The outlet consists of an ungated conduit discharging into Mad River. Flood flows exceeding the capacity of the conduit would be automatically stored in the reservoir. The size of the conduit will permit passage of

the normal flow of the river without appreciable storage in the reservoir.

83. Regulation of Conservation Pool. - Regulation of the conservation pool will be accomplished by means of the conservation weir with crest at approximately elevation 872. A hand operated slide gate in the conservation weir will permit partial unwatering of the pool, if required. A low flow outlet consisting of a six or eight-inch gated pipe discharging through the conservation weir will be provided. The pipe will extend upstream to near the deepest portion of the pool and will draw off oxygen deficient water detrimental to fish life.

X. OPERATION AND MAINTENANCE

84. Operation. - No flood control operation will be required. The dam will automatically reduce flood discharges in the Mad, Still and Farmington River sub-basins of the Connecticut River watershed.

85. Maintenance. - The dam and appurtenant structures will be maintained by the State of Connecticut. Maintenance will be based on regular, detailed inspection of the entire works, and include all actions necessary to preserve the structures.

86. Annual Charges. - Annual charges given in Table III below have been computed as outlined in EM 1120-2-104 using an economic life of 50 years for the project. The salvage value of land and net loss of taxes for land is not included. The loss in taxes is expected to be offset by increased value and productivity of lands downstream of the project. The interest rate on local costs for lands and rights-of-way is $3\frac{1}{2}$ percent. An additional $2\frac{1}{2}$ percent has been included for loss in productivity on lands in accordance with EM 1120-2-104.

TABLE III

ANNUAL CHARGES

Federal Investment	
Total Federal First Cost	\$5,500,000
Interest during Construction ($\frac{1}{2}$ of 3-year period @ 2.5%)	206,200
Gross Federal Investment	\$5,706,200
Non-Federal Investment	
Total Non-Federal First Cost	\$ 645,000
Interest during Construction ($\frac{1}{2}$ of 3-year period @ $3\frac{1}{2}\%$)	33,900
Gross Non-Federal Investment	\$ 678,900

TABLE III (cont'd)

ANNUAL CHARGES

Federal Annual Charges	
Interest on Gross Investment at $2\frac{1}{2}\%$	\$ 142,700
Amortization of Gross Investment, 50 years at $2\frac{1}{2}\%$	<u>58,500</u>
Total Federal Annual Charges	\$ 201,200
Non-Federal Annual Charges	
Interest on Gross Investment at $3\frac{1}{2}\%$	\$ 23,760
Amortization of Gross Investment, 50 years at $3\frac{1}{2}\%$	5,180
Maintenance and Operation	4,000
Loss of Productivity of Lands	<u>4,260</u>
Total Non-Federal Annual Charges	37,200
TOTAL ANNUAL CHARGES	\$238,400

Y. PUBLIC HEALTH INSECT AND WATER POLLUTION CONTROL

87. Public Health Insect and Water Pollution Control. - In 1956, commenting on the interim report on the Mad River Dam and Reservoir, the Public Health Service of the U. S. Department of Health, Education and Welfare wrote as follows:

"Our review of the report indicates that there will be no water supply, water pollution control, or vector control problems associated with the project. However, in order to minimize mosquito problems, it is recommended that borrow areas be graded to drain."

Further comment is contained in letter of 25 February 1960, which is reproduced as Exhibit No. 1 following the text of this design memorandum. The last paragraph states that, "It appears that the project, if constructed, will not involve any major problems in water pollution or water supply".

Z. FISH AND WILDLIFE RESOURCES

88. Fish and Wildlife Resources. - A report to the Connecticut Water Resources Commission prepared by the Board of Fisheries and Game of the State of Connecticut in cooperation with the U. S. Fish and Wildlife Service, dated 16 February 1960, was sent to this office on 23 February 1960 by the Commission.

Formal transmittal of the report of the U. S. Fish and Wildlife Service has not been made but representatives of the Service have indicated their concurrence with the State report. The report states that Mad River is a trout stream of fair value and that damage to the fishery resource will be heavy because of construction of the project. It furthermore states that project construction and operation will reduce to a considerable extent the production of most forms of native game species. Hunting pressure in the area has always been relatively heavy due to the proximity of the City of Winsted. The report makes the following recommendations:

"1. Provide a conservation pool approximately 10 acres in size, directly behind the main dam on the Mad River as a mitigating measure for damages caused by the project to fish and wildlife.

2. Install a gated pipe at the bottom of the conservation weir (vicinity of 855-foot level) that will extend into the reservoir to the 836-foot level for the purpose of drawing some of the deep cold bottom water and thereby alleviating severe summer stagnation.

3. Retain (do not destroy) present Route 44 within the reservoir area to provide access, parking and boat launching facilities for the conservation pool behind the dam. If, in the event fill is to be taken from the bed of Route 44 above the 872-foot contour, it would be desirable to retain the Old Norfolk Road as an access road along the north side of the recreation pool to a point suitable for parking and access.

4. Borrow Area designated as "C" between Mad River and Route 44 be so worked as to provide recreation area (possibly swimming and skating) for residents of Winsted and surrounding villages.

5. Borrow Area "A" northeast of dam and south of relocated Route 44 be worked in such a manner as to leave a body of water for wildlife habitat and/or warm water fishing area.

6. The Board of Fisheries and Game would like to see all of the acreage within this impoundment in public ownership. There would be considerable recreational opportunity, assuming public ownership, on that land lying between present Route 44 and the relocation of that route. If any of these lands are not to be acquired in fee, this Department would like to obtain long term hunting and fishing leases. It would be to our advantage to obtain these leases at the same time the State is contacting the landowners for flowage easement.

7. Request that Corps of Engineers and Board of Fisheries and Game be given opportunity to review borrow area specifications by the Corps of Engineers."

This office concurs in Recommendations Nos. 1 and 2 as project modifications to mitigate damages to fish and wildlife which would be caused by the project. This office also concurs in Recommendation No. 3 that access over Route 44 or Old Norfolk Road be retained. Such access is required for maintenance of the dam and removal of trash from the intake. Recommendations Nos. 4 and 5 will be accomplished as part of contract operations if such can be done without additional cost or any interference with the authorized work. Recommendation No. 6 is being considered by the Water Resources Commission of the State of Connecticut who are planning to acquire necessary interests in real estate. In accordance with Recommendation No. 7, the U. S. Fish and Wildlife Service and the Board of Fisheries and Game of the State of Connecticut will be given an opportunity to review and discuss with personnel of this office borrow area specifications prior to the issue of bid invitations.

AA. HYDROPOWER

89. Hydropower. - The Flood Control Act of 1958, under which the project is authorized, provides "That penstocks and other similar facilities adapted to possible future use in the development of hydroelectric power shall be installed in any dam authorized in this act for construction by the Department of the Army when approved by the Secretary of the Army on the recommendation of the Chief of Engineers and the Federal Power Commission". As a result of studies made for the review of the interim report by the Corps of Engineers and the Federal Power Commission, it was found that no modification in the plan will be necessary to provide for the future development of hydroelectric power. Letter of the Federal Power Commission dated 29 January 1960 confirming this finding is reproduced as Exhibit No. 2 following the text of this memorandum.

BB. ECONOMICS

90. Benefits. - The project will produce major flood reductions in the city of Winsted and important reductions at other downstream damage centers on the Still, Farmington and Connecticut Rivers. The record flood of August 1955 caused a loss of over \$47,000,000 in the main damage reaches downstream of the reservoir site. Of this, \$18,000,000 occurred in the Winsted area. It is

estimated that about \$19,000,000 of the total loss would have been prevented had the project been in operation during that flood. Average annual flood damage prevention benefits of \$370,000 would accrue in the main-stem reaches downstream of this project.

91. Benefit-Cost Ratio. - The annual cost, as shown in paragraph 85, Table III, is \$238,400. The ratio of benefits to cost is 1.6 to 1.

CC. RECOMMENDATION

92. Recommendation. - It is recommended that the project and relocations plans submitted in this report be approved for construction of relocations and for development of Design Memoranda on "Embankments and Foundations" and "Detailed Design of Structures".

390,000
370,000
20,000 - benefits

TABLE II

DETAILED COST ESTIMATEU. S. ROUTE 44 RELOCATION
(Replacement in Kind)

<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
Clearing & Grubbing	12,200	L.F.	\$ 1.25	\$ 15,250
Earth Excavation	50,000	C.Y.	.50	25,000
Rock Excavation	135,000	C.Y.	1.85	249,750
Ordinary Borrow	185,000	C.Y.	.60	111,000
Gravel Borrow	25,000	C.Y.	1.25	31,250
Bit.Treated Gravel Shoulder	22,000	S.Y.	.60	13,200
Reinf.Conc.Pavement	30,300	S.Y.	5.25	159,075
Drainage	2.3	Miles	50,000	115,000
Dust Control		L.S.		1,000
Shaping & Cleaning Slopes	12,200	L.F.	1.00	12,200
Concrete Curbing	1,250	L.F.	2.50	3,125
Concrete Sidewalk	3,500	S.F.	1.00	3,500
Bit.Conc. Lip Curb.	7,300	L.F.	.50	3,650
Fencing	4,500	L.F.	.70	3,150
Guard Rail	11,200	L.F.	2.00	22,400
Box Culvert Sta.45+70	150	L.F.	250.00	37,500
Bridge Sta.101+20	2816	S.F.	25.00	70,400
Maint. & Protection of Traffic		L.S.		5,000
				\$ 881,450
				<u>131,550</u>
				1,013,000
Contingencies + 15%				

TABLE IV
DETAILED COST ESTIMATE
DAM AND RESERVOIR
(Including Road, Bridge and Grounds)
(February 1960 Price Level)

ENR Construction-Cost Index Feb. 1960 = 812.68 (1913 = 100)

<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
Preparation of Site (40 Ac.)	Job	L.S.		\$ 40,000
Clearing Reservoir	Job	L.S.		5,000
Care and Diversion of Stream	Job	L.S.		50,000
Common Excavation-General	165,000	C.Y.	0.80	132,000
Rock Excavation	85,000	C.Y.	2.50	212,500
Common Excavation -Borrow				
a. Impervious and Random	1,650,000	C.Y.	0.65	1,072,500
b. Pervious and Gravel	240,000	C.Y.	1.50	360,000
Rock Excavation - Borrow	88,000	C.Y.	1.80	158,400
Rolled Embankment	1,240,000	C.Y.	0.18	223,200
Additional Rolling	1,000	Hrs.	20.00	20,000
Gravel Bedding	77,000	C.Y.	1.00	77,000
Rock Fill	75,000	C.Y.	0.80	60,000
Rock Slope Protection	81,000	C.Y.	1.00	81,000
Safety Mesh	44,000	S.F.	2.50	110,000
Rock Filter	16,800	C.Y.	3.00	50,400
Compacted Backfill	1,000	C.Y.	1.50	1,500
Road Gravel	4,000	C.Y.	1.00	4,000

<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
Mass Concrete - Spillway Wall & Weir	1,400	C.Y.	30.00	42,000
Reinforced Concrete - Spillway Lining and Apron	1,000	C.Y.	45.00	45,000
Bridge Concrete - Abutments	150	C.Y.	50.00	7,500
Bridge Concrete - Superstructure	40	C.Y.	75.00	3,000
Reinforced Concrete -Intake and Outlet Structures	100	C.Y.	75.00	7,500
Reinforced Concrete -Conduit	3,000	C.Y.	50.00	150,000
Portland Cement	8,500	Bbl.	5.50	46,750
Reinforcement Steel	180,000	Lb.	0.20	36,000
Grouting	Job	L.S.		20,000
Anchor Bars - 6 Foot Setting	450	Ea.	25.00	11,250
Anchor Bars - 10 Foot Setting	150	Ea.	35.00	5,250
Drilling Drain Holes	1,700	L.F.	5.00	8,500
Rubber Water Stop	700	L.F.	3.50	2,450
Miscellaneous Iron and Steel	10,000	Lb.	0.80	8,000
Pipe Hand Railing	100	L.F.	3.50	350
Chain Link Fence	2,300	L.F.	3.50	8,050
Structural Steel, Access Bridge		L.S.		25,000
Slide, Gate and Hoist, Complete		L.S.		5,000
Low Flow Outlet, Complete		L.S.		2,500
Gages, Recording and Staff, Complete		L.S.		15,000

<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
Log Boom		L.S.		\$ 5,000
Bituminous Surfacing	7,200	S.Y.	2.50	18,000
Cable Guard Rail	7,100	L.F.	2.75	19,525
Flag Pole		L.S.		2,000
Grounds		L.S.		10,000
				<u>3,161,125</u>
	Contingencies 15%			<u>475,875</u>
Cost of Dam and Appurtenances				<u>3,637,000</u>
Relocations				
Roads, U.S. Route 44	1,013,000			
Utilities	<u>24,000</u>			
Total Relocations				1,037,000
Engineering and Design				408,000
Supervision and Administration				400,000
Preauthorization Studies				<u>18,000</u>
TOTAL FEDERAL COST				5,500,000
Lands and Damages	645,000			
TOTAL NON-FEDERAL COST				<u>645,000</u>
TOTAL PROJECT COST				\$ 6,145,000

DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
REGIONAL OFFICE

PUBLIC HEALTH SERVICE

REGION 11
42 BROADWAY
NEW YORK 4, N. Y.

Refer to: 24: SE

25 February 1960

SPECIAL DELIVERY

Mr. John Wm. Leslie
U. S. Army Engineer Division, New England
Corps of Engineers
424 Trapelo Road
Waltham 54, Mass.

Dear Mr. Leslie:

Reference is made to your letters of January 18 and February 10, 1960 regarding the Mad River (Connecticut) Flood Control Dam and Reservoir.

As now proposed, a permanent pool at elevation 855.0 is reasonably assured. However, it appears likely that the project will include an alternate permanent pool for Fish and Wild Life Conservation at elevation 872.0. The pools would have surface areas of approximately 5 acres and 10 acres respectively. In either case, the Top of Dam will now be at elevation 995 and the Spillway Crest at elevation 983.0.

If the project includes the Fish and Wild Life Conservation Pool an ungated outlet works will be constructed as indicated in the Preliminary Drawings included with your letter of February 10. The outlet works would include a low flow outlet about 6 inches in size to draw off the minimum stream flow from near the bottom of the pool and a 4 foot sluice gate to permit drawing down the pool at about elevation 855.0.

We understand that water supply storage was reviewed with the selectmen of Winsted, Connecticut; they told the Corps of Engineers that the Water Company could not afford the extra cost required to provide water supply storage; and consequently no provision for water supply will be incorporated in the project.

It appears that the project, if constructed, will not involve any major problems in water pollution or water supply.

For the Regional Engineer.

Sincerely yours,

Lester M. Klashman
Lester M. Klashman

Acting Regional Program Director, WS&PC

EXHIBIT NO. 1

FEDERAL POWER COMMISSION

REGIONAL OFFICE

139 CENTRE STREET, NEW YORK 13, N. Y.

January 29, 1960

The Division Engineer
U. S. Army Engineer Division, New England
Corps of Engineers
424 Trapelo Road
Waltham 54, Massachusetts

Dear Sir:

In reply to your letter of January 18, 1960 re: Mad River Flood Control Dam and Reservoir, Mad River, Winchester, Connecticut, this office finds that the power potential of the proposed project would be relatively small and economically infeasible of development, as previously stated in our comments on your interim report of 1956.

We, therefore, concur with the recommendations contained in your letter that the project should be constructed without provisions for future power development at the site.

Sincerely yours,

D. J. Wait
Regional Engineer

By John H. Spellman
Acting

APPENDIX A

ATTORNEY'S REPORT

RE: Relocations - Mad River Dam and Reservoir Project

1. Public Law 85-500, 85th Congress, approved July 3, 1958, authorized the project for MAD RIVER DAM and RESERVOIR on the MAD RIVER above Winsted, Connecticut. This project is authorized substantially in accordance with plans and recommendations as outlined in House Document No. 137, 85th Congress, 1st Session.

2. The said House Document No. 137, recommended the construction of an earth-fill dam 168 feet high and 1040 feet long at the then estimated cost of \$5,430,000.00.

3. Within the proposed dam and reservoir area, there are one State highway, five Town roads and one private road, telephone distribution lines, and electric distribution lines which will interfere with the construction, maintenance and operation of the Mad River Dam and Reservoir Project. All the above roads and utilities are situated in the Town of Winchester, Connecticut. There is no railroad within the proposed area. Therefore, the relocation, rearrangement, alteration and/or abandonment of the above mentioned will be required.

4. State Highway: There is a Connecticut State Highway within the proposed Mad River Dam and Reservoir Area. Connecticut State Highway U. S. Route No. 44 (formerly a part of the old Norfolk Road) crosses the proposed dam site and continues up the valley towards the Town of Norfolk within the proposed reservoir area. This Connecticut State Highway is now below spillway crest elevation of 983.0. It will interfere with the construction of the proposed dam and will be subjected to inundation by reason of the operation and maintenance of the Mad River Dam and Reservoir Project. It is an important East-West travelway, connecting the highly industrialized cities and towns in the greater Winsted, Connecticut area. Therefore, its relocation will be required. The ownership, jurisdiction and control of said highway is in the State of Connecticut, State Highway Department. It is the opinion of the undersigned that the State of Connecticut has a compensable interest in U.S. Route 44 and is entitled to the reasonable cost of necessary location, rearrangement and/or alterations.

5. Town of Winchester: There are several highways of the Town of Winchester within the proposed Mad River Dam and Reservoir area, namely: Old Norfolk Road #1, Old Norfolk Road #2, Old Norfolk Road #3, Rattle Valley Road and Rugg Brook Road. These roads will be

subjected to inundation by reason of the construction, maintenance and operation of the project and the alteration and/or abandonment of some or all of these roads will be required. These roads are under the control and jurisdiction of the Town of Winchester as public highways. Therefore, it is the opinion of the undersigned that the Town of Winchester has a compensable interest in the above mentioned roads and is entitled to the reasonable cost for any necessary alteration.

6. Private Road: There is one private road within the proposed Mad River Dam and Reservoir Area, namely: Side Road. Side Road will be subjected to inundation by reason of the construction, maintenance and operation of the project and the abandonment of this road will be required or at least a portion of it. This road leads off of the Old Norfolk Road #3 to the property of Mr. Leo Nikora but does not appear as a Town Road on "Town Roads of Winchester - The Connecticut Highway Department Map - Revised January 1959 TR-162."

7. Southern New England Telephone Company: Southern New England Telephone Company operates and maintains distribution lines within the proposed Mad River Dam and Reservoir Area. The distribution lines of the Southern New England Telephone Company are located along public ways in the Town of Winchester, Connecticut. The locations are occupied by virtue of statutory authority and the charter of the Company. These lines will be affected by the construction, operation and maintenance of the project and a relocation, rearrangement or alteration will be required. It is the opinion of the undersigned that the Southern New England Telephone Company has a compensable interest therein and is entitled to the reasonable cost of any necessary relocation, rearrangement or alteration.

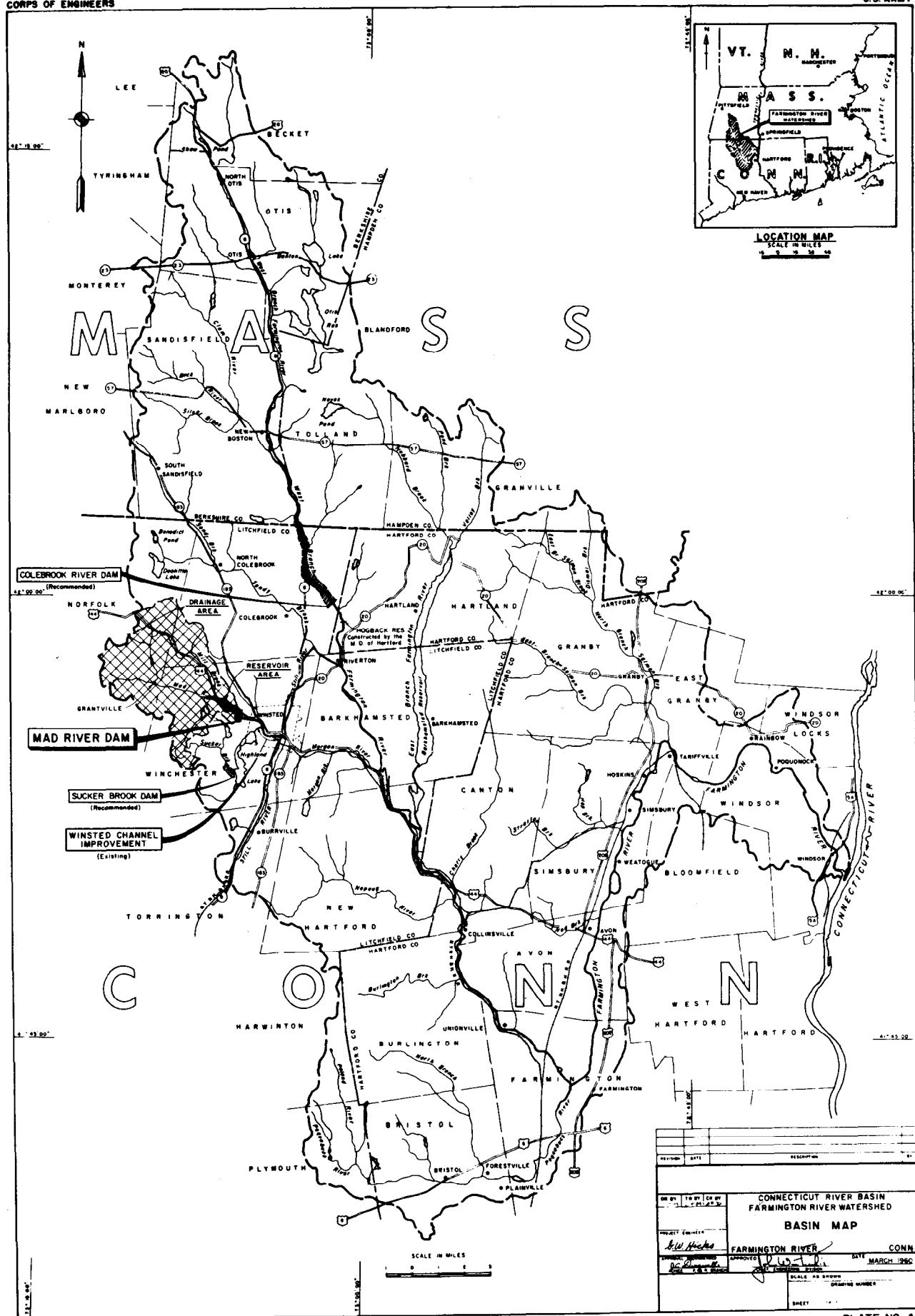
8. Connecticut Light and Power Company: The Connecticut Light and Power Company also maintains and operates distribution lines in the Town of Winchester, Connecticut within the proposed Mad River Dam and Reservoir Area. These distribution lines are located on the public highways of the above mentioned Towns, and the locations are occupied by virtue of statutory authority and its charter, and one single grant by easement of a distribution line in this area. These distribution lines will be affected by the operation and maintenance of the project and a relocation, rearrangement or alteration will be required. Some of the poles are jointly owned with the Telephone Company. It is the opinion of the undersigned that the Connecticut Light and Power Company has a compensable interest therein and is entitled to the reasonable cost of any necessary relocation, rearrangement or alteration.

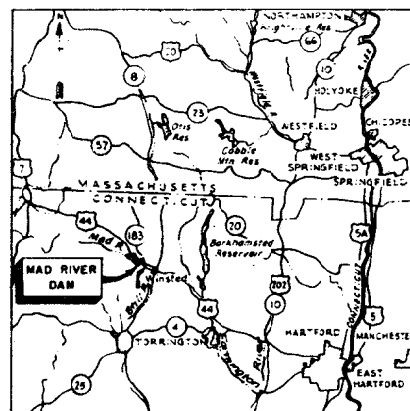
9. Miscellaneous: The Central New England Railroad is now abandoned but its bed was where part of Route 44 was straightened out in 1939 to 1942. This right-of-way was purchased by the H. E. Salzberg Co., Inc. and some of the land was taken by the State of Connecticut

in 1939 for straightening out Route 44. Later the balance of the land or most of it has been deeded to Jacob Kaufman by the H. E. Salzberg Company, Inc. in 1954, Winsted Land Records, Book 109, Page 23.

A handwritten signature in cursive script, reading "Malcolm F. Steele". The signature is written in dark ink and is positioned above the printed name.

MALCOLM F. STEELE
Attorney





SCALE IN MILES
0 5 10 15 20

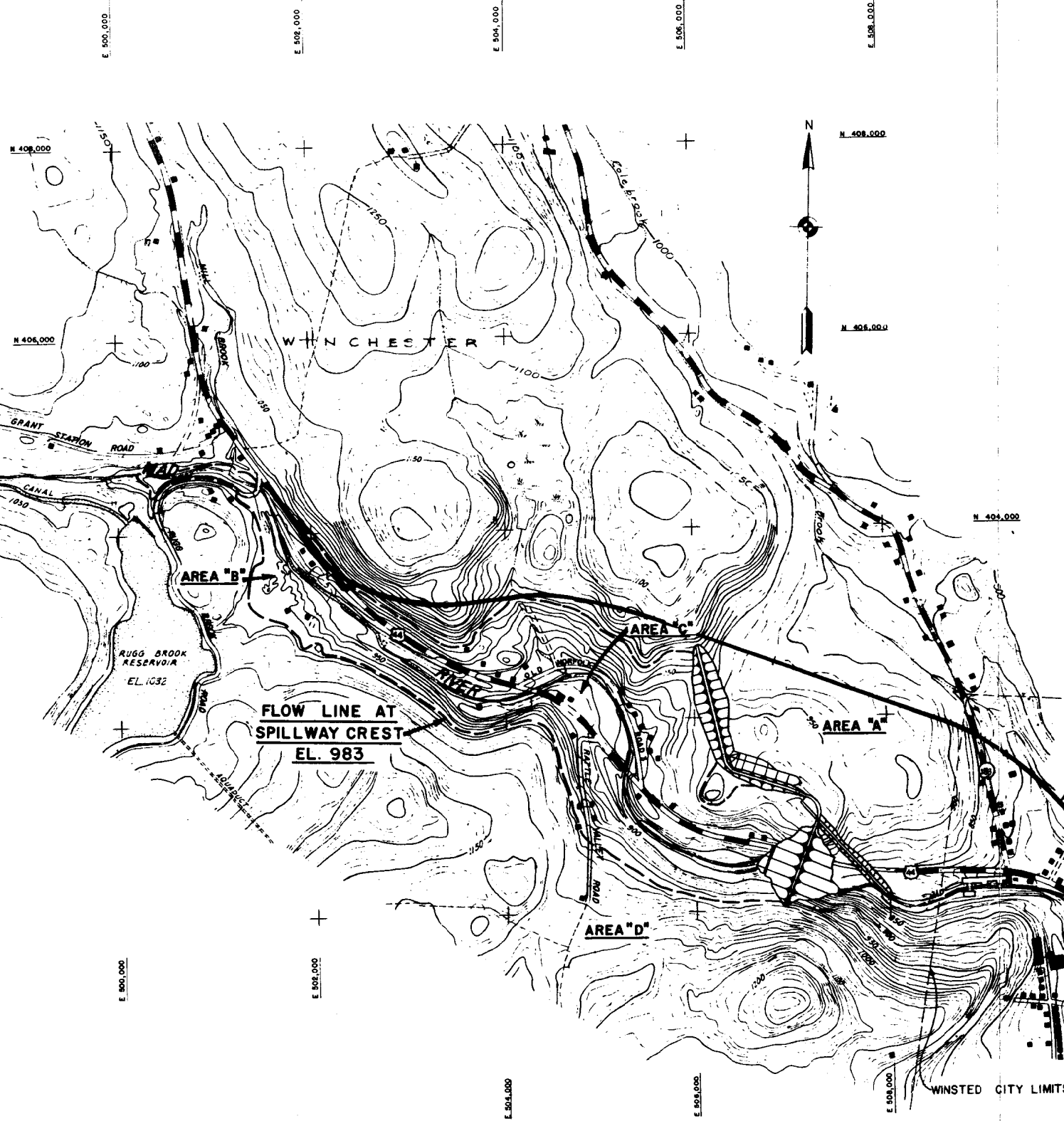
N 404,000

N 408,000

N 400,000

LEGEND

- Existing gravel roads
- Surface Town roads
- Reservoir at spillway crest, EL. 983
- Relocated highway
- State and Federal Highways
- Winsted City Limit



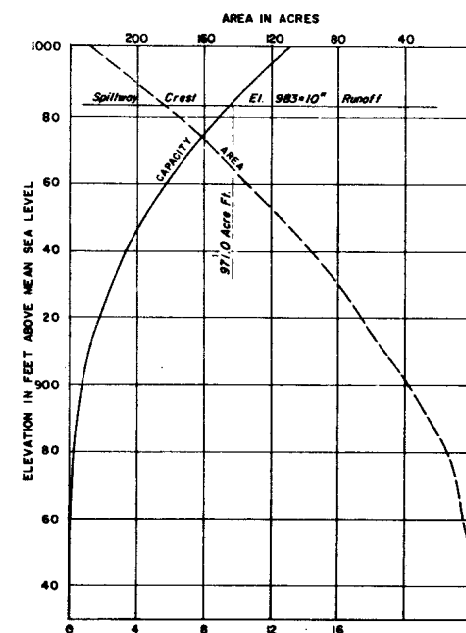
RESERVOIR PLAN

SCALE IN FEET

0 500' 1000' 1500'

NOTES

Elevations refer to Mean Sea Level Datum
Contour interval equals ten feet
Topography is based on U. S. G. S. and Army
Map Service Maps.

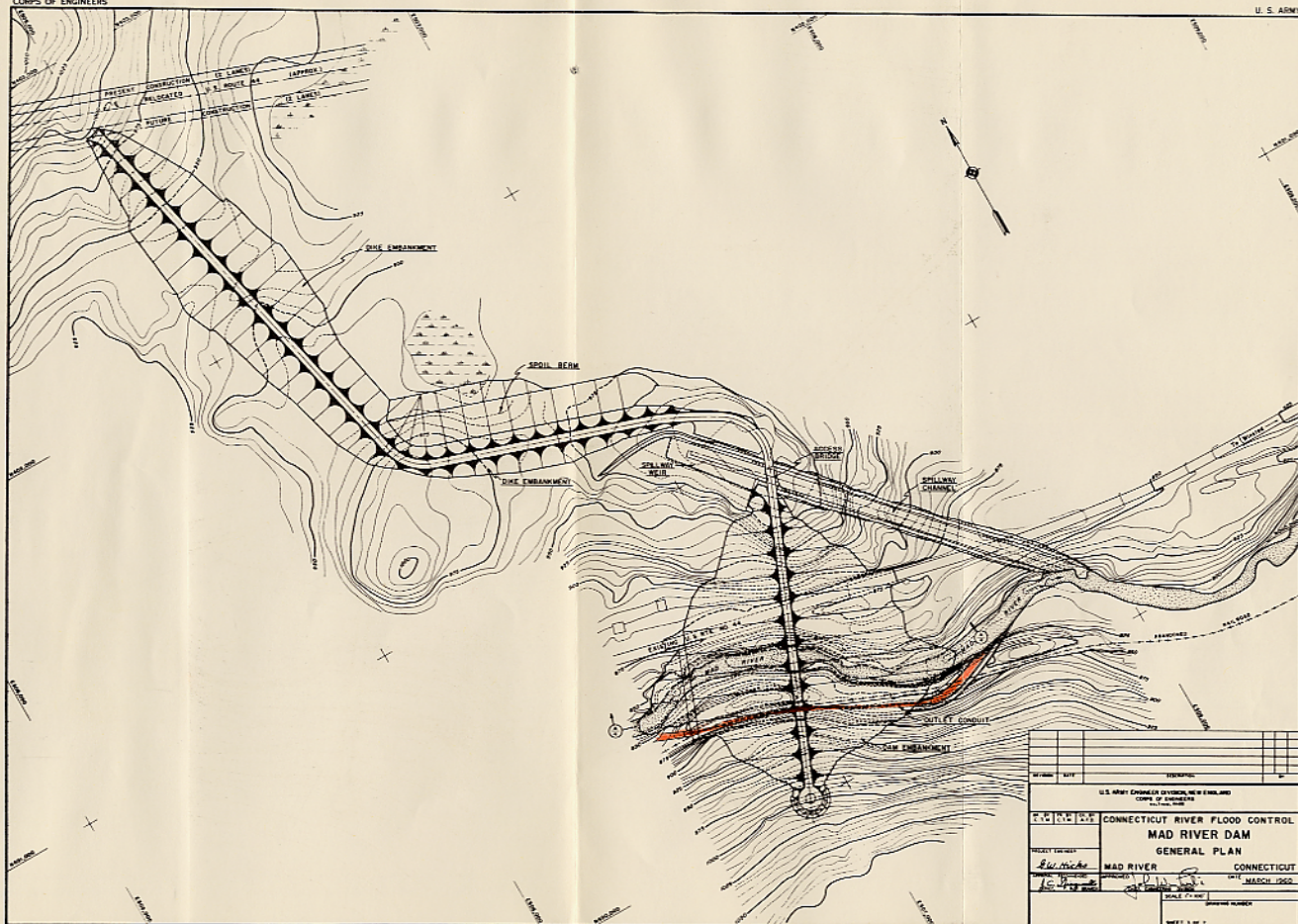


CAPACITY IN THOUSAND ACRE-Feet
AREA AND CAPACITY CURVES
DRAINAGE AREA 18.2 SQ. MILES
(1" OF RUN-OFF=971 ACRES - FEET)

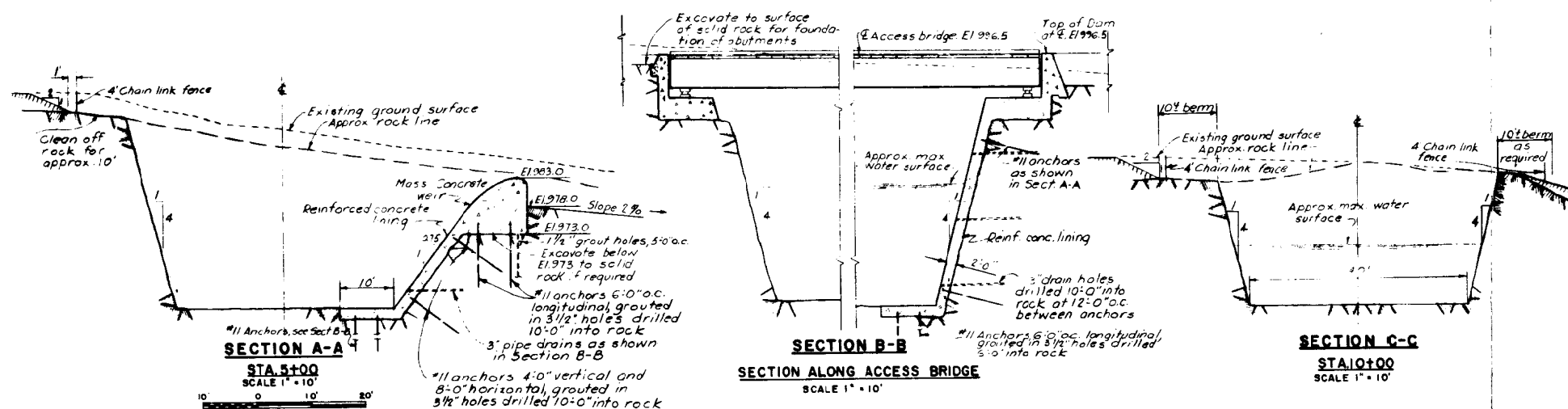
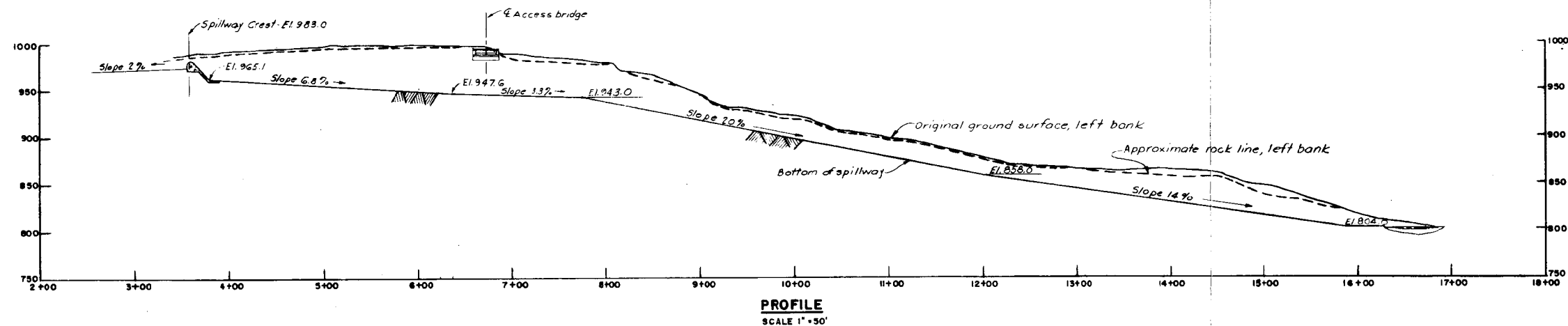
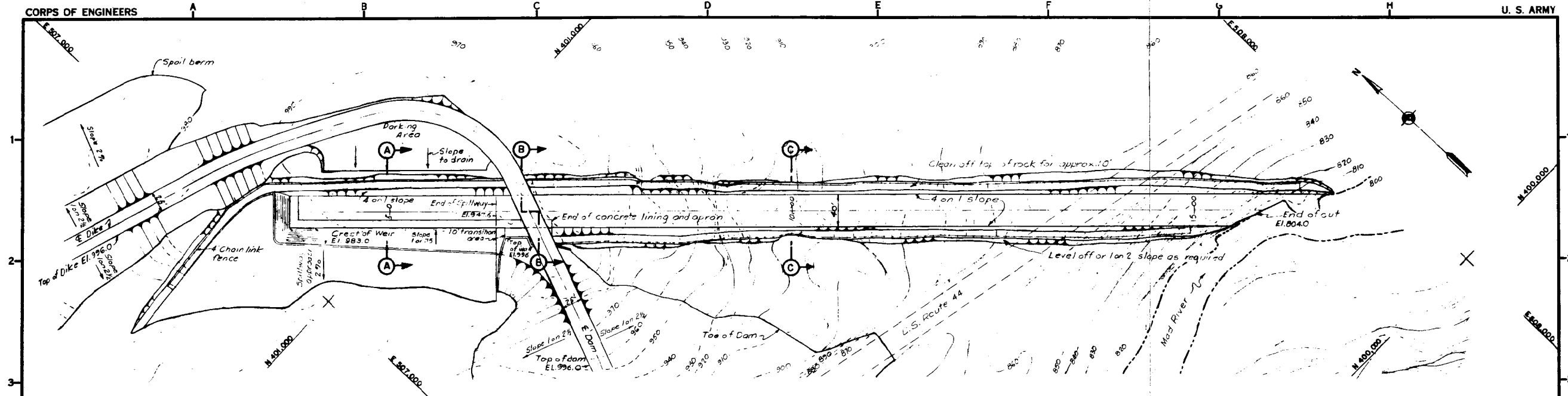
N 508,000

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U. S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
CONNECTICUT RIVER FLOOD CONTROL			
MAD RIVER DAM RESERVOIR MAP			
DR. BY JGC	TR. BY J.F.	CK. BY A.F.D.	DATE MARCH 1980
PROJECT ENGINEER R.W. Hicks		APPROVED J.E. Dwyer	
APPROVAL RECOMMENDATION J.E. Dwyer		SCALE AS SHOWN DRAWING NUMBER	
SHEET 2 OF 7			

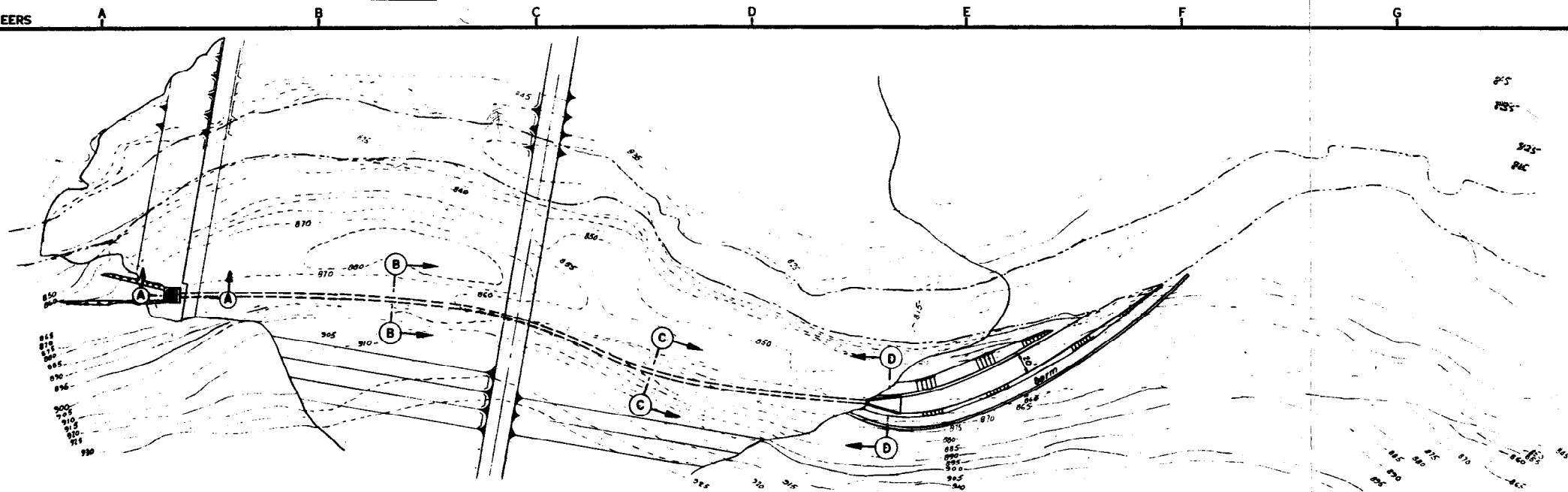




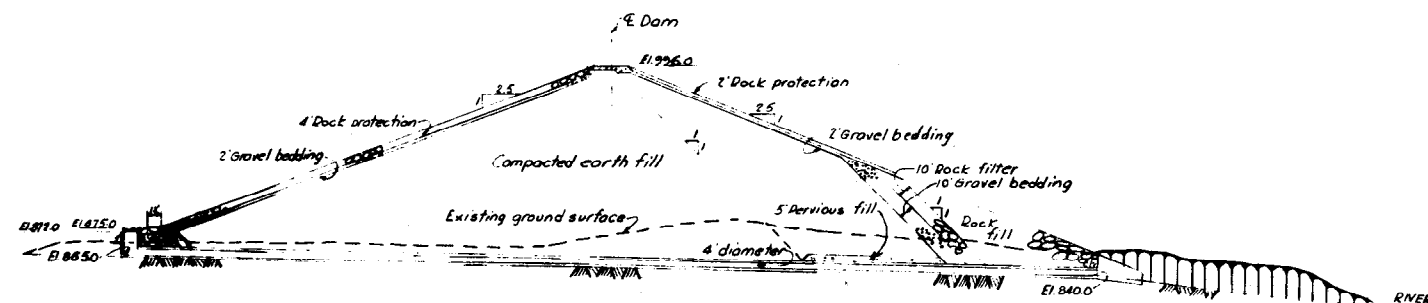


REVISION	DATE	DESCRIPTION	BY

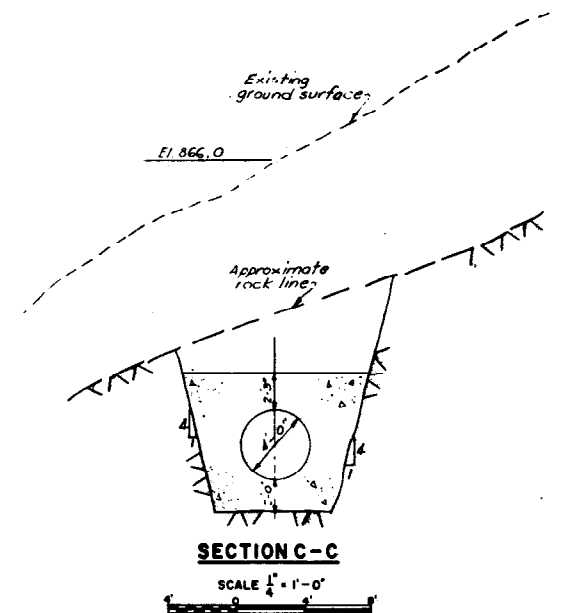
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.			
CONNECTICUT RIVER FLOOD CONTROL MAD RIVER DAM SPILLWAY PLAN, PROFILE AND SECTIONS			
DES. BY R.D.R.	DR. BY A.J.M.	CHK. BY A.P.B.	PROJECT ENGINEER <i>J.W. Hines</i>
APPROVAL RECOMMENDED <i>J.C. [Signature]</i> CHIEF, P.E. BRANCH		APPROVED <i>[Signature]</i> CHIEF, ENGINEERING DIVISION	
DATE MARCH 1960		SCALE AS SHOWN	
DRAWING NUMBER		SHEET 5 OF 7	

**PLAN OF OUTLET WORKS**

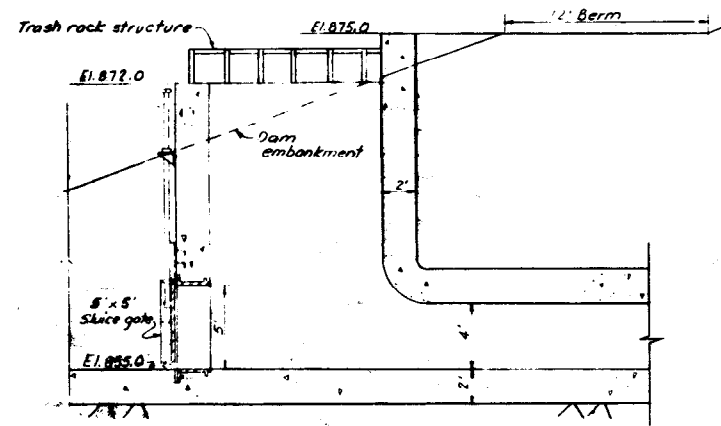
SCALE 1" = 50'

**PROFILE ALONG E OUTLET WORKS**

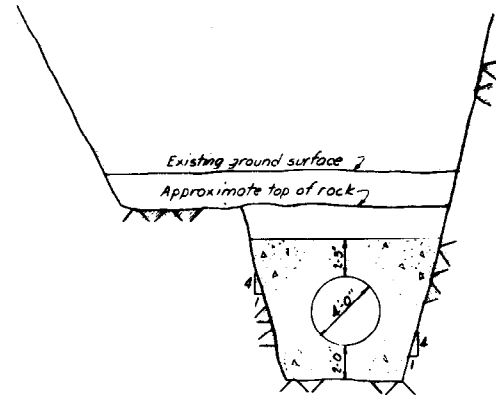
SCALE 1" = 50'

**SECTION C-C**

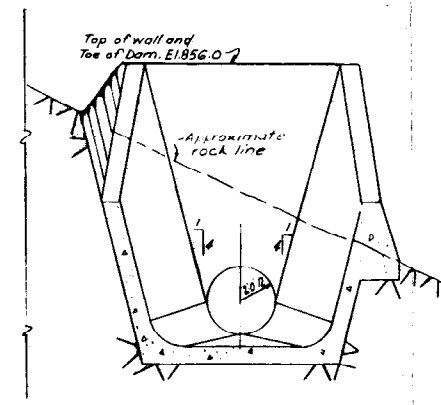
SCALE 1" = 1'-0"

**SECTION A-A**

SCALE 1" = 1'-0"

**SECTION B-B**

SCALE 1" = 1'-0"

**SECTION D-D**

SCALE 1" = 1'-0"

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
MILITARY, MAINE

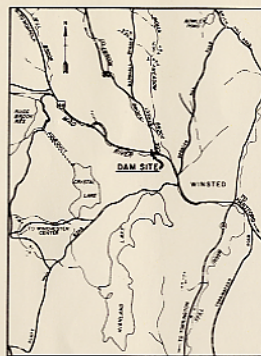
DES BY: JEM | DR BY: JEM | CR BY: JEM | A/JH | AFD

PROJECT ENGINEER: *A.W. Hicks*

CONNECTION RIVER FLOOD CONTROL
MAD RIVER DAM
OUTLET WORKS
PLAN, PROFILE AND SECTIONS
MAD RIVER, CONNECTICUT
DATE: MARCH 1950

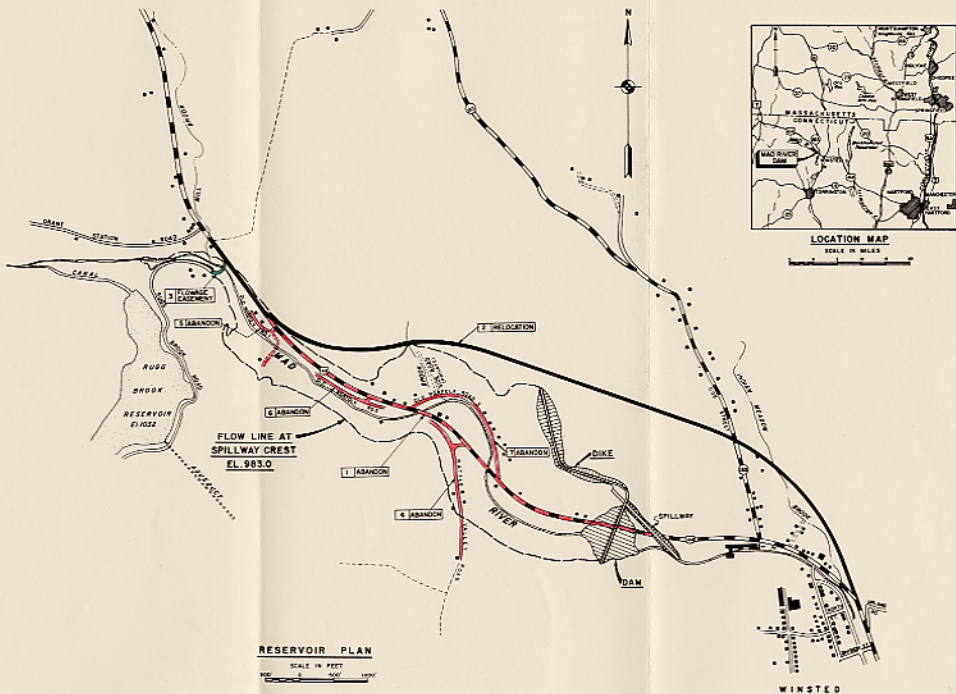
APPROVED: *[Signature]*
U. S. ARMY ENGINEER DIVISION

SCALE AS SHOWN
DRAWING NUMBER
SHEET 6 OF 7



VICINITY MAP

SCALE IN MILES



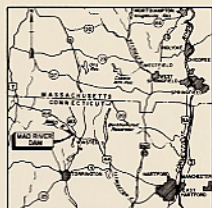
RESERVOIR PLAN

SCALE IN FEET



LEGEND

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- 100. DAM SITE



LOCATION MAP

SCALE IN MILES



WISCONSIN		DATE		LOCATION	
U.S. ARMY ENGINEER DIVISION, NEW HAVEN, AND CORPS OF ENGINEERS					
CONNECTICUT RIVER FLOOD CONTROL					
MAD RIVER DAM					
HIGHWAY RELOCATIONS					
PROJECT NUMBER		MAD RIVER		CONNECTICUT	
DATE		MARCH 1950		SHEET NUMBER	
SCALE		AS SHOWN		SHEET 2 OF 2	